The Long Haul

Turbo Diesel Adventures with Journalist Moses Ludel.

"INSTALLING A REDESIGNED FLUIDAMPR HARMONIC DAMPER"

In 2011, TDR writer David Magnoli did a thorough article about the crankshaft vibration damper. The article detailed the damper's function, the Cummins strategy for countering engine vibration and information about upgrade dampers. This article is available at the Turbo Diesel Register's website, "The Perfect Collection," pages 36-45.

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This is the OEM damper from my 2005 engine at 182,930 miles. The rubber is fully intact while showing normal striations from doing its job. Indexing marks are virtually aligned and well within the one-sixteenth inch allowable offset. Despite the Hypertech Max Energy power tune, torque loads placed on this engine have been moderate.

Inspection

Following the factory service manual (FSM) guideline, I routinely inspected my 2005 Ram's harmonic damper. Though often overlooked, damper inspection is an important maintenance step. The back-and-forth twisting of a crankshaft produces torsional frequency vibration. If left unchecked, vibration can reduce power output, decrease fuel efficiency and severely damage critical engine parts.

The damper counters frequency vibration created by torque force during the engine's power strokes. As the hub and inertia ring work to decrease the vibration, the energy heats up the rubber. The 5.9L two-piece damper needs replacing when torque loads and heat take their toll on the rubber.

Usually Cummins dampers get replaced when there is visible rubber deterioration, noticeable vibration or damper pulley wobble. The factory service manual illustrates a defective damper as rubber ooze from the hub-to-ring gap or the inertia ring creeping on the hub. With the damper tuned to one frequency, excess creep between the inertia ring and hub means that harmonic vibration is unchecked. *The maximum indexing offset is only one-sixteenth inch.*

Why a Fluidampr?

Fluidampr has been a crankshaft damping solution for decades. The company's legacy goes back to a postwar torsional viscous damper for commercial diesel engines. These engines were eating up conventional friction and rubber dampers and breaking costly crankshafts. The breakthrough silicone fluid viscous damper solved this problem and proved less expensive than elaborate gear and pendulum dampers.

Bernard E. O'Conner at Houde Engineering pioneered the rotary silicone viscous damper in 1946. Truckers soon nicknamed these torsional viscous dampers the "O'Conner." Houde Engineering evolved into Houdaille Industries and produced over 1.5 million heavy duty torsional viscous dampers for on and off-highway diesel engines between 1946 and 1973. In 1973, 90% of the company's production was on-highway diesel trucks.

The company evolved into Vibratech, Inc. Today Vibratech TVD is the parent company, specializing in severe duty diesel viscous damping solutions for a global market. The modern Fluidampr division focuses on automotive performance and light truck diesel needs. From the late eighties forward, Fluidampr has been an innovator for stock replacement damper upgrades, balancer solutions and as a resource for both gasoline and diesel race engine builders.

A Fluidampr is a substantial improvement over the Cummins factory dampers. Rather than a hub with an outer inertia ring separated by elastomer "rubber," the one-piece Fluidampr has a floating internal steel "flywheel" or inertia ring surrounded by silicone fluid. The shearing of the silicone fluid counters vibration over a wide range of harmonic frequencies and rpm. Fluidampr makes performance upgrade vibration dampers for both the 5.9 and 6.7-liter Cummins engines.

The main advantage of the Fluidampr, and its popularity with commercial users and high performance engine builders, is vibration damping over the full rpm range. Stock Cummins engines do not operate at high rpm like a race engine. However, the OEM damper's tuning covers a narrow rpm band. This rpm is only a fraction of the engine's operating rpm. Shown is the Fluidampr 920301 harmonic damper for the 2003-2007 engine.

Modifications to the engine tune, including software performance upgrades, can increase crankshaft loads and vibration amplitude. The amount of twist increases steadily from the rear to the front of the crankshaft. Extra horsepower or increased torque impact the force applied to the crankshaft during each cylinder's power stroke. Power strokes twist the crankshaft, and the crankshaft oscillates on the rebound. The Fluidampr provides viscous torsional vibration damping, a safety net for engines with power output changes or heavier crankshaft loads.

An added benefit of viscous damping is a measurable gain in torque and horsepower. Crankshaft oscillation and frequency vibration diminish valve timing accuracy. Excessive harmonic vibration robs the engine of torque. While aftermarket tuning software alters fuel flow and boost, a Fluidampr mechanically increases torque and horsepower by offering wide range vibration damping that increases available torque.

My column, "The Long Haul," focus is on powertrain, axle and chassis longevity. Protecting the engine's crankshaft and reciprocating parts is a piece of that equation. In retrospect, the addition of a Fluidampr should have accompanied the Hypertech Max Energy software tuning that I added. Like most of us, I focused on the improved throttle response and power increase without consideration for the OEM crankshaft damper's limitations. If increased torque is the goal, a wide rpm range viscous damper would be advisable.

A lighter-use truck can get by with a stock replacement damper. Vibration has never been noticeable on my engine. However, from a longevity vantage or concern for crankshaft bearing and timing gear wear, a Fluidampr should be valued as preventive care. It's your call. Geno's Garage has a great price for the Mopar 05086735AA harmonic damper, currently at $399.95. The 920301 Fluidampr for the same 2003-2007 engine is $558.45.

The New Design Fluidampr

When David Magnoli wrote the Fluidampr article in 2011, there was one thing that was missing from the Fluidampr design. The Fluidampr housing is larger in diameter than the OEM damper (9-1/4 inch versus approximately 8-3/4 inch). Limited clearance between the fan pulley and the Fluidampr required detaching the damper from the crankshaft to remove and install the drive belt.

With the automatic belt tensioner, a drive belt can normally be changed quickly. Belt failure on the road with the original Fluidampr design meant crawling beneath the truck to loosen four tight damper bolts then juggling a twenty-three pound damper. If the fan shroud and fan were in the way and needed removal, changing a drive belt grew into a tool intensive job. Alongside the road or at an RV park, a belt change would be daunting.

A redesign of the Fluidampr part has eliminated this issue. A chamfer at the inner edge of the housing shell now allows belt removal and installation with the damper in place. Once the damper is installed properly, a Fluidampr can last 500,000 miles or longer. As a preventive measure, many replace the timing cover seal when installing the damper.

This is the new design damper for 2003-2007 Cummins engines. The chamfer seen at the inside edge is the clearance necessary to easily remove and install the drive belt. The change makes belt service in the field quick and eliminates the need to remove the damper.

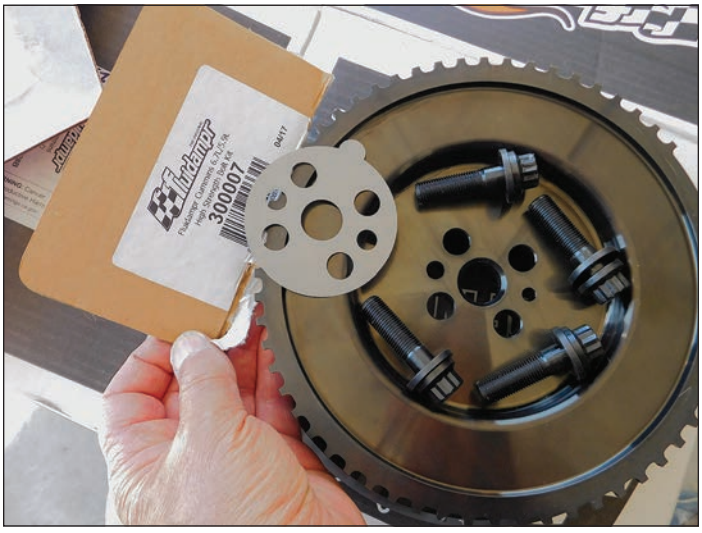
Proper damper installation requires consideration for the type of fasteners, cleanliness and correct torque procedure. OEM damper bolts have been confusing. Can the bolts be reused? The factory torque for 2005 Ram/Cummins OEM damper bolts calls for 30 ft. lbs. plus an additional 60-degree turn of the bolt. These figures reflect a “torque angle” (TA) tightening method. With TA bolts, the manufacturer prefers using an angle gauge. An initial torque setting is applied then a specific rotating angle follows to achieve the desired torque setting.

These are not torque-to-yield (TTY) or torque + angle-to-yield (TAY) bolts. When TTY or TAY bolts are used, Mopar and other manufacturers emphasize installing new bolts whenever the bolts are removed. There is no mention of this requirement in the 2005 Ram FSM.

TTY or TAY Note: The first time a new TTY or TAY bolt is installed, an elongation of the bolt’s shank takes place as the bolt rotates the required degrees. This plasticity or deformation permanently stretches the bolt to assure consistent clamping force. Once stretched, a true TTY or TAY bolt should never be reused. An attempt to reuse the bolt would stretch it further and create the risk of bolt shear in service. If you do encounter TTY or TAY fasteners, sometimes notable by their narrower shank below the bolt head, replace them with OEM replacement TTY or TAY fasteners.

Of course, inspecting bolt condition and checking for thread stretch with a thread pitch gauge is always prudent. If bolts are suspect, or you simply want to start fresh, Mopar OEM and Cummins replacement bolts are available. Be certain that the bolt length is correct for the crankshaft’s thread depth and the thickness of the damper hub flange.

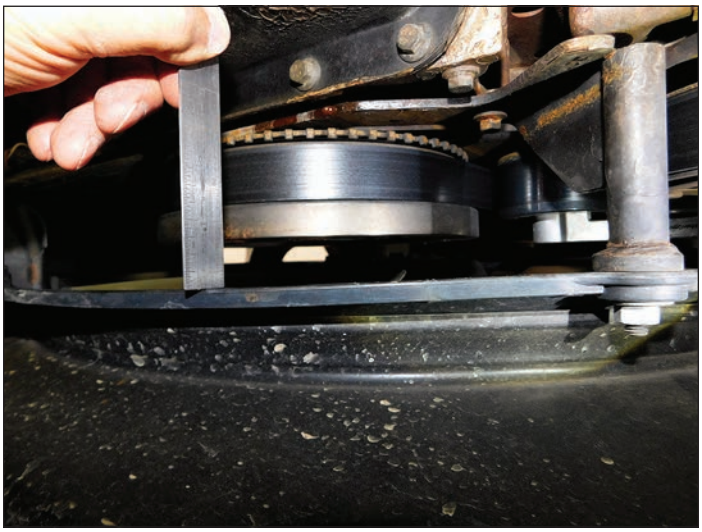
For easier field service and assured quality, I opted for the Fluidampr P/N 300007 fastener kit. Produced by ARP, the bolts are high tensile and can be reused. Threads and the chamfered (locking) washers get a dab of anti-seize. No thread locker is used. Torque is 95 ft. lbs. for these ARP bolts. (Consult your FSM for recommended torque on OEM bolts.) I torque bolts like these to maximum torque in three stages, tightening in cross then a final torque check in a circular pattern. A torque re-check takes place after the engine has run to operating temperature and cooled down.



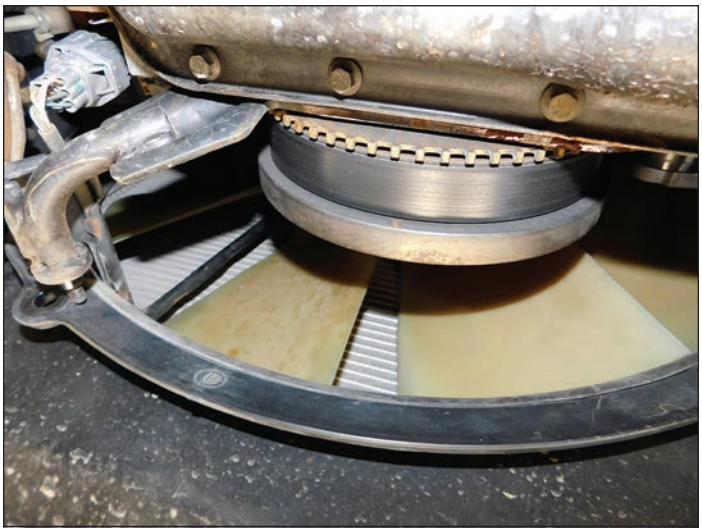
The Fluidampr 300007 High Strength Bolt Kit was my choice for fasteners. The kit consists of high performance ARP bolts and chamfered washers. Fluidampr adds the diamond impregnated friction washer for superior clamping. This kit will handle up to 700 horsepower and 1250 foot-pounds torque. My engine puts out half that power. The Fluidampr will stay in place!

An Installation Method and Tool Suggestions

Always refer to your model year FSM and the instructions furnished with your new parts. Here are some tips on how I installed the new Fluidampr on my 2005 Cummins engine. I would use this same approach for a stock replacement damper. The niche tools make the job easier and safer. These tools cost far less than the labor charges for getting this work done at a dealership or independent shop. Better yet, I get to keep the tools for future work:



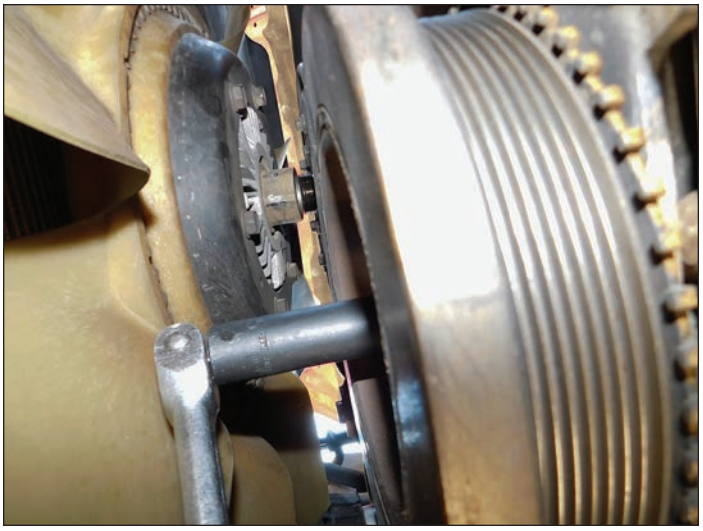
Step 1—On an earlier 5.9 engine the damper removal is possible without removing the fan and shroud. The 2005 Ram FSM calls for removing *both*. There is ¾-inch clearance between the stock damper and the plastic fan blades. The Fluidampr is even deeper, reducing this clearance further.



Step 2—After assessing the clearance and options, my choice is to loosen the fan shroud top and bottom, then carefully compress the shroud forward. Offsetting the plastic shroud slightly, I perch the shroud at the end of each mounting stud. This opens up clearance at the bottom of the shroud.

Step 3—The next step is to loosen the fan coupler from the drive hub. I plan to *reuse* the fan assembly. This Lisle 43300 pneumatic driver kit includes a 36mm adapter. (Price is $135.99 at Summit Racing.) Using an inexpensive Pittsburgh serpentine belt tool *(shown)*, I hold the belt tension firmly to prevent pulley rotation. With the fan assembly supported by mechanic's wire, I use my air hammer and the Lisle tool to quickly work the threaded coupler loose. The fan is suspended away from the drive hub and radiator core. Watching and protecting the wiring sleeve to the fan clutch, I lower the fan assembly carefully to the base of the shroud, keeping the fan blades safely away from the radiator core.

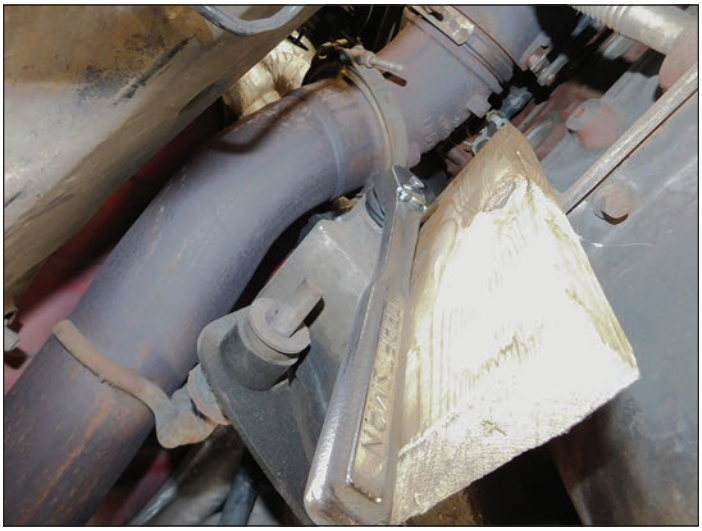
Step 4—A Cummins barring tool is an investment that pays for itself on this job (OTC part number 7471A). (Some hold the crankshaft pulley with a ratchet strap to save buying this tool. If you do service work on your engine, get the tool.) The barring device, a block of wood and a ¼-inch square drive ratchet will hold the crankshaft/flexplate in the correct position for loosening the damper bolts.



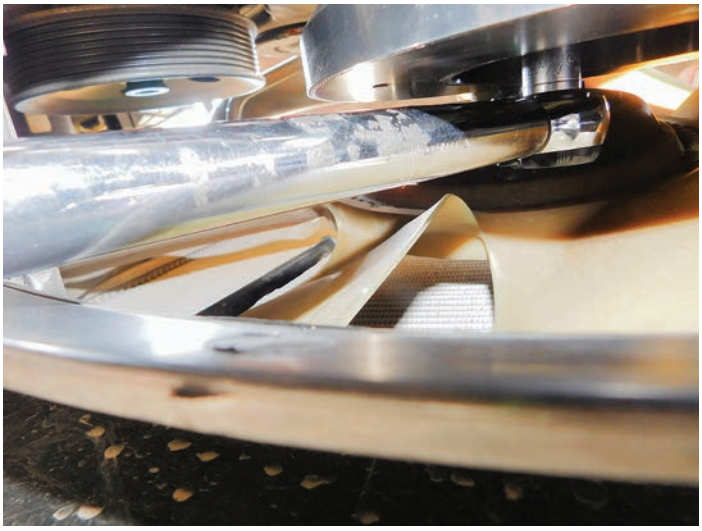
Step 5—Now I have some open space for accessing the crankshaft damper bolts! The fan leans from the lower shroud toward the engine at the top, the blades are not touching the radiator core. Using a common ½-inch breaker bar and a deep six-point socket, I apply strong, steady force to the OEM bolt heads and *stay out of the breaker bar's path*. These bolts loosened without great difficulty. There is ample room for installing the Fluidampr. Though it might be easier with the shroud and fan completely removed, this is reasonable room for safe, thorough work.

Step 7—The Fluidampr 300007 kit instructions call for use of anti-seize on the ARP bolt threads. In calling Fluidampr, the recommendation is either ARP Ultra Torque Lube or a quality bolt/engine fastener anti-seize. If using anti-seize as I do here, the recommendation is a "small dab" at the end threads and under the washer and bolt head. The washer chamfer faces the bolt head. ARP is concerned about torque accuracy. Additional concerns include heat, rust and bolt removal in the future.

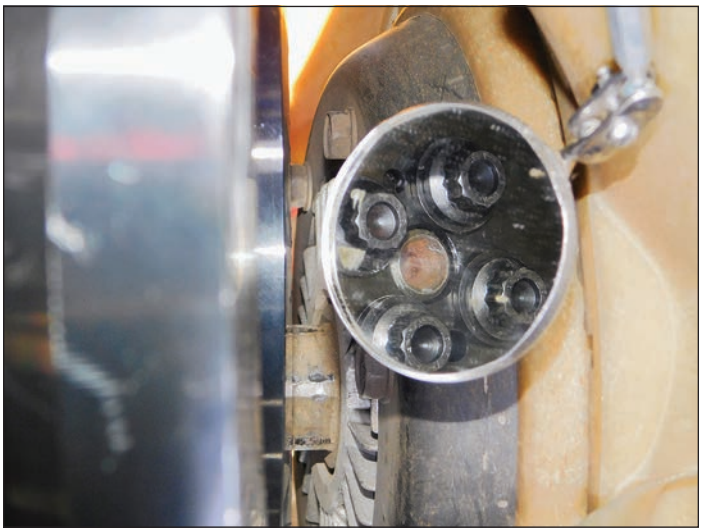
Step 6—I clean the exposed crankshaft end with a shop towel and naphthalene. I use Scotchbrite on the centering pilot, if necessary. Clean crankshaft threads carefully if there are any signs of rust. Use compressed air to clear the area and threads, avoiding the seal lip. If the seal needs replacing, now is the time. Note that the length of bolts is longer when mounting a Fluidampr. Use the correct length bolts for the type of damper you are installing!



Step 8—Now I switch the block of wood and OTC 7471A barring tool to provide a counterforce for tightening the crankshaft damper bolts. The block of wood and ratchet are snug in that direction, the barring tool firmly in place. This works far better than ratchet straps and other methods. It works on flywheel and flexplate starter ring teeth without damaging parts. Do not waste money on imitation knock-off barring tools. The OTC tool works properly and is also useful for valve adjustment, valve and fuel injection timing plus other Cummins service work. Rotating the crankshaft with the OTC 7471A is easy.



Step 9—I can swing the torque wrench with a 14mm 12-point socket for the ARP bolts. I tighten in cross with three stages: 40, 75 and 95 ft-lbs. At 95 ft-lbs, I let the bolts set for a while then re-torque in cross followed by a final circular pattern. Fasteners can be checked after an engine heat and cooling cycle. If using OEM bolts, follow the torque and tightening recommendations in your FSM.



Step 10—Mirror viewing helps in a space like this. I confirmed that the friction washer remained in place and centered before installing the bolts. After aligning the crankshaft dowel pin with the smaller indexing hole in the damper, I caused the pin's position with a mirror. (The opposite hole is larger and intended for a Fluidampr "pin kit" available for high performance use.) Other than feeling the bolts and washers with fingertips, this is the only way to assure proper alignment of parts while centering the damper on the crankshaft. Bolts are seated squarely and uniformly.

Step 11—A built-in tone ring is one less issue to address. Be careful, however, when hoisting the 23 pound damper into position. Do not damage the sensor pickup seen near the tone ring. The air gap between the damper tone ring teeth and pickup must be correct. If the pickup is undamaged, the gap will be right. Earlier 5.9L engines require relocating and adjusting the sensor pickup. Read the Fluidampr instructions carefully.

Now the fan assembly and coupler can be installed. Make sure that the wiring sleeve to the fan coupler stays in alignment and does not get damaged during fan installation. I use the Lisle 43300 to tighten the coupler nut after first installing the drive belt. Factory coupler torque is 85 ft-lbs, which requires a lengthy 36mm fan wrench. The air hammer can be applied at the same force that loosened the coupler. I tension the belt with the serpentine belt tensioner tool while tightening the coupler with the Lisle pneumatic tool.

After realigning the shroud, I installed the four nuts that secure the shroud to its brackets. Nut torque is 18 ft-lbs for my truck. Make sure the wiring sleeve to the fan assembly is aligned and out of harm's way before starting the engine.

Don't Forget the Water Pump and Idler Pulley

As you can see from the damper installation, there were signs of coolant seepage from the water pump's weep hole. Although not a full-fledged leak yet, the engine is going to get its second water pump replacement. With the shroud loose and fan uncoupled, the water pump renewal was easier. Renewing the water pump, installing a new heavy duty drive belt and replacing the original idler pulley became part of the Fluidampr project.

Having replaced the automatic belt tensioner during the previous water pump change, I left the belt tensioner alone. A Gates 43526 water pump had been my choice when the original Cummins pump failed. The Gates pump lasted as long as the OEM Cummins pump at a fraction of the Cummins or Mopar price. Geno's Garage offers the 43526 and other water pump applications plus Mopar and Cummins cooling system products.

I managed just over 100,000 miles from the original Cummins water pump and eighty thousand miles from the Gates pump. The new Gates 43526 pump has some changes. Immediately visible, the impeller hub on the pump that I received rides flush with the end of the shaft. I contacted Gates and spoke with a corporate product manager who shared key measurements. He noted that the pump is on specification for new Gates engineering guidelines. We will see whether the design change affects longevity and whether this change is lasting.

The 43526 Gates pump still looks ruggedly built and cast nicely with good machining. The impeller shaft, however, fits flush with the end of the impeller hub. On the earlier pumps and in ad photos for the 43526, the shaft protrudes through the impeller.

There was a very slight wobble in the idler pulley at the last belt change. With the shroud out of the way, the timing was right for a new idler pulley. Dorman products have worked well for my Jeep service work, and I ordered a Dorman 419-685 idler pulley. A wise choice, the pulley features a far more substantial bearing than the OEM piece.

The new Dorman 419-685 Idler Pulley fits 2003-up Dodge and Ram 5.9 and 6.7 applications. For the 2005 engine, the original idler (at left) has a smaller bearing than the Dorman part. The larger bearing in the Dorman idler should improve performance and longevity. Now the Fluidampr, water pump and idler pulley have a fresh start. The new heavy duty drive belt will run true.

My truck is once again tow-ready for the trip to the 2021 SEMA and AAPEX Shows. Preventive care keeps the vehicle reliable and safe. The payments ended fourteen years ago, and every trouble-free mile is money saved.

For more information on harmonic dampers, read David Magnoli's coverage in the "Perfect Collection" pages 36-45.

Moses Ludel
TDR Writer
www.4WDmechanix.com