

Subject:

Diagnosing noise problems in manual transmissions

Essential Reading:

- ✓ Rebuilder
- ✓ Shop Owner
- ✓ Center Manager
- ✓ Diagnostician
- ✓ R & R

Author:

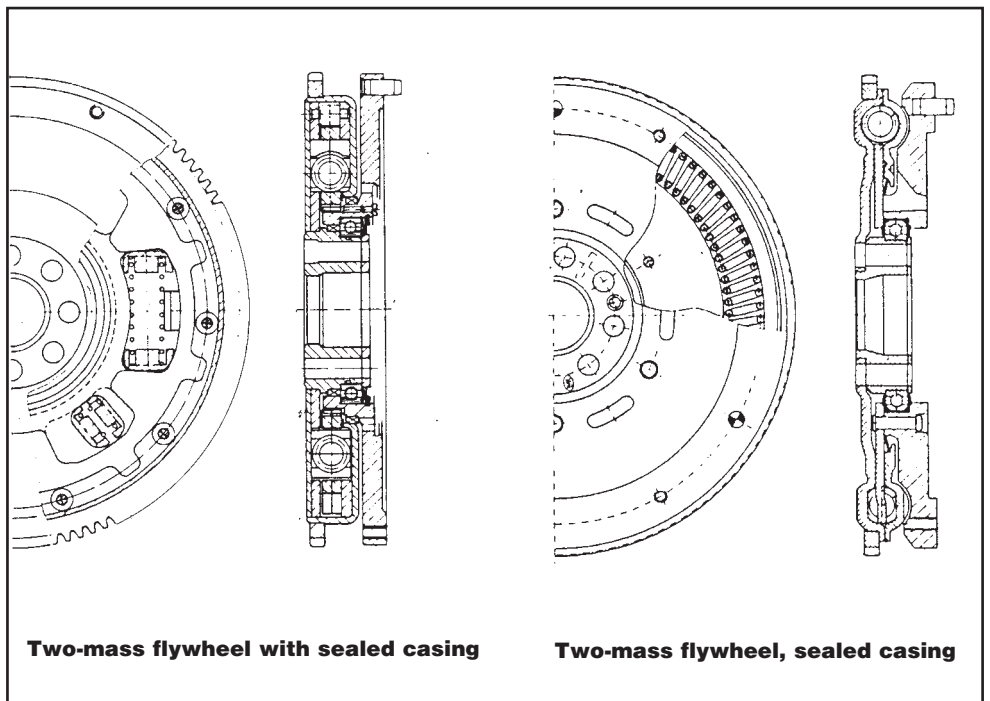
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Solving Common Noise Problems, and Problems with No Solutions

Noise is one of the great mysteries of the transmission world. Noise is subjective, and people rarely can interpret noises in the same manner. Noise travels much faster and farther in solid objects such as the steel of an automobile than it does in air. There is driveline noise, engine noise, suspension noise, exhaust noise and road-generated noise.

There is also the mysterious “never had that before” noise. This noise usually comes to the customer’s attention as a result of a change of habits created by having shelled out a large sum to repair their vehicle. After such an expense, the customer is driving the vehicle with the radio off and all interior appliances such as A/C shut down, listening intently to the trans-



mission they just paid for. Present are the normal tire and road-surface noise, wind noises and rattles that have been with the vehicle for many moons but are now readily apparent to the driver, who no longer is listening to his favorite tunes at 120 decibels.

Manufacturers go to great lengths to produce vehicles with very low noise levels. The car is tuned and insulated to get rid of harmonic vibrations that cause discomfort for the driver. Transmissions and final drives are designed with gear angles for strength and low noise generation. Interiors are heavily insulated against noise, vibration and harshness (NVH), and the entire chassis is designed with various devices to make NVH occur at acceptable levels to the driver. Any changes to the chassis such as insulation or items left off during the installation of the transmission can open the door for customer NVH complaints. The carmaker is profit motivated, and no part installed on the vehicle has no function; they are all necessary.

The most-common transmission noise and the greatest waster of labor hours is neutral-rollover noise. There is no such thing as a completely silent transmission. All rotating parts create some level of noise and vibration. The engine creates harmonic vibrations because of the firing pulses of each cylinder. If these harmonic vibrations are allowed to travel into the transmission through the input shaft, they cause the gear train to rattle, and this is gear rattle or neutral-rollover noise. The manufacturers do all they can to damp these vibrations in the engines with balance shafts and dual-mass flywheels, and proper clutch-disc-hub damper springs.

Gear rattle or neutral-rollover noise occurs in neutral with the clutch engaged, and at various speeds in other gears to a lesser de-

gree. The best test for this type of noise is to start the engine, place the transmission in neutral, have the clutch engaged (pedal up) and slowly add throttle from idle speed to 2,500-3,500 rpm. If it is gear rattle the noise will float out as the engine speed increases.

Gear rattle or neutral-rollover noise does not affect the operation of the transmission or do any damage to the gear train, but you can't sell that to a customer who has just spent money on repairs. On larger transmissions in pickup trucks you can actually see it occur. Drain out the lubricant and remove a power-takeoff plate. Start the truck in neutral with the clutch engaged, and watch the gears shake.

Since this is not a transmission problem, nothing you do inside the transmission will make this go away. The cause is engine harmonics influencing the gear train. To get rid of the noise we need to go to the clutch, dual-mass flywheel or the engine running condition and sort that out.

Dual-mass flywheels have primary and secondary plates with spring loading between them. If the springs have lost their tension, engine harmonics will rattle the gears.

On the clutch disc we will have damper springs on the hub that are calibrated to the engine firing pulses to damp them from passing through to the transmission. Installation of an incorrect clutch disc for the application or hub dampers that are no longer functional will create rollover noises.

The condition of the engine tune is critical to this discussion. Bad injectors, plugs or wires, or worn cams and timing chains can create harmonics that no dual-mass flywheel or clutch disc can stop from rattling the gears. On diesel engines pay attention to the injector pump, which is how diesels are timed. A worn or out-of-time pump will greatly magnify engine

harmonics and create customer complaints.

Certain models of transmissions are highly prone to gear rattle, and to be successful in their repair one needs to fully inspect the clutch and flywheel components and the engine tune level. These transmissions are the New Venture Gear 1500 in 2.2-liter GM 2WD trucks; 2550 in 2.5-liter Jeep 2WD and 4WD models; 3500 in 4.3-, 5.0- and 5.7-liter GM and Dodge trucks; 3550 in 4.0-liter Jeep 2WD and 4WD; 4500 in GM/Dodge trucks; and the 5600 in Dodge trucks. The ZF Ford truck transmissions, S5-42, S5-47, S6-50 and S7-50, and the Corvette S6-40 transmission also have had gear-rattle complaints. Once more, if it is gear rattle that leaves with a slow increase in engine speed in neutral, no amount of disassembly of the transmission will make it go away.

Problems with few or no solutions

In 1988 GM introduced the HM 290 series of five-speed transmissions for its C and K truck transmissions. Designed by Getrag, these were extremely over-engineered designs, with too many parts (there were 96 pieces in the shift mechanism alone) and requiring special essential tools for repairs. GM and Chrysler created a joint venture called New Venture Gear involving the GM Muncie plant and the New Process Gear division of Chrysler.

As I had predicted in conversations with engineers at Hydramatic all those years ago, the HM 290 design was a nightmare. The transmission was redesigned and called the 5LM60, and this too proved to be problematic. A further redesign produced the second variation of the 5LM60, which still had four shift rails and the same problems.

The engineers at New Venture redesigned the latest version of the 5LM60 into what you now know as

the NV 3500, which was a single-rail transmission. The unit had internal noise concerns that were not to be cured. The 3500 countergear is supported by straight roller bearings at the front and rear. Without tapered roller bearings or washers to shim the endplay on the shaft, there is no way of controlling the endplay.

These units frequently suffer from a tip-in clunk when the clutch is engaged and a similar clunk on coast-down when the clutch is released. This occurs because of excessive movement of the countershaft due to the natural tendency of helical-cut gears to try to move away from each other under torque and to contract together when the torque load is released. This problem often results in as much as 1/4 inch of endplay in the shaft.

If you have a customer complaint of tip-in clunk, remove the oil drain plug, which is at the bottom of the transmission case. After the lube drains out, take a long flat-blade screwdriver and place it on the counter gear and see how much endplay you have. This will be your clunking noise, and we have found no way to cure it. I have seen a C truck in which a Chevy dealer installed five factory units with no good outcome, and GM finally bought the vehicle back under a lemon-law case.

The NV 3550 is a variation of the 3500 that is used behind the 4.0-liter engine in Jeeps. This unit suffers from incurable gear rattle, gear jump-out and notchy, noisy shifting. There is one cure for this condition, and that is to replace the unit with an AX15, which is a direct bolt-in, using the same clutch set, hydraulics, cross member and driveshaft. Depending on the model and year of the Jeep it may be necessary to change the shifter and the input shaft of the transfer case. We have developed a kit for this replacement.

The joint venture between the GM Muncie plant and the New Process division of Chrysler has ended. The GM Muncie plant has been closed and all the machinery sold off. Chrysler kept the New Venture name for the New Process plant but no longer builds any of the previous models.

Subsequently, Chrysler sold the New Venture/New Process Division to Magna International, a major tier-one OEM supplier. This partnership sucked \$80 million to \$100 million of profit out of New Process Gear when it was owned by Chrysler and produced a great number of transmissions for which no OEM replacement parts are available. When you have to rebuild one of the units you now have to rely on aftermarket parts. Many of these parts are well made and will give good service, but most of these Getrag-based designs have noise issues that cannot be resolved. If you are working on one of these units discuss these issues with the customer so you don't wind up taking responsibility for something you did not create. **TD**