



The Keys To The Kingdom

Or How To Unlock The Innermost Secrets Of A Gearbox

By Mike Weinberg
Contributing Editor

Over the years this magazine has published hundreds of articles on the techniques and theory of transmission repair and diagnostics. Reading every page of every issue is close to getting a degree in practical real-world knowledge that will improve your career. The trend in our industry is to focus on the "fix," the quick way to diagnose a problem, the latest correction of a design flaw. This article will be devoted to something more mundane and perhaps little thought about.

In standard-transmission repair the most important stage of the process of rebuilding the gearbox is the tear-down or "internal inspection." I am sure that some of you readers will not agree with me on this statement, but read on and maybe I can convince you. The key to a lasting repair that allows the shop to rebuild a unit profitably IS the tear-down. To prove my point I will take you through the steps of a proper internal inspection.

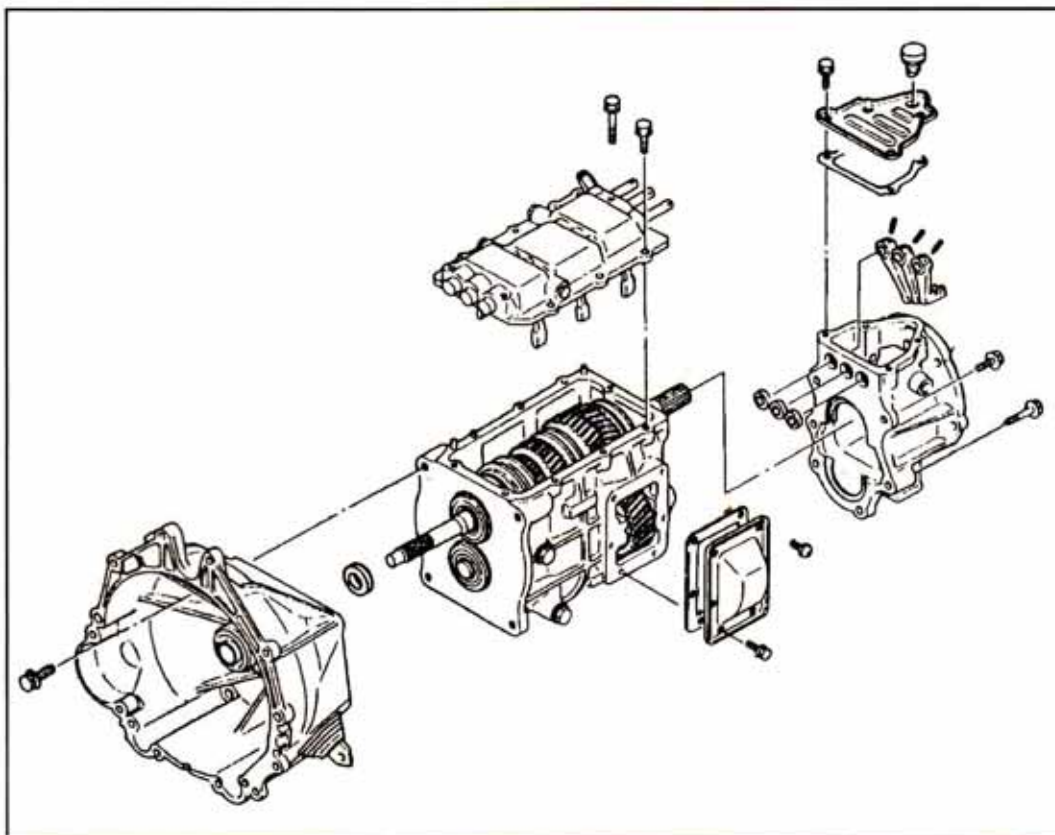
Before a wrench is put to the gearbox, some very im-

portant steps need to be taken. First, with paper and pen in hand we need the following information: Year, make, model, engine size, VIN and production date. Now to the unit at hand: Identify the unit, get tag numbers, case casting numbers, shift housing numbers, and front bearing-retainer numbers. Half the battle in getting the right parts is to be sure which model trans you are working on. We have all seen units that were swapped in previous repairs that are not correct for the model and have ratio or drivability problems.

Next on our inspection is to check endplay. This is one key to

understanding what went wrong with the unit and where to look for damage. This information will be lost forever if we don't check it before the unit is disassembled. After noting overall unit endplay, feel for preload and any rough bearings while shifting the unit through the gears. Inspect the trans externally. Is the front bearing retainer worn or grooved out? Are there any broken or stripped bolts, damaged mounting points? Is the pilot-bushing journal on the input worn? Are the clutch splines straight and clean? Check all external linkage, shift levers, switches, the shift tower and the stick

continues page 66



itself, and all external splines.

Now put the wrench to work and separate the cases. When the case halves are split and the internal components are visible, check the relative position of all shaft components and inspect everything for obvious wear or breakage. Check for broken helical teeth on the gear train. Check the synchro sleeves for radial and axial play. Turn the bearings and look for roughness, excess play, noise or contamination with foreign matter. Inspect the shift forks for fit to the slider and cracks or wear. Look at the inside of the cases for contact damage, worn-out bearing or rail bores, cracks, etc. Look at the magnet if the unit is so equipped. Spreading this junk metallic debris on a clean shop towel will tell you a lot about what is wrong with the unit.

Before taking apart any of the shaft components, make sure you have a die grinder handy. Match-mark the front bearing retainer to the case if it is round. Match-mark each synchro slider to its hub. Make the marks on the side that is facing you when you remove it from the shaft. This will index the parts for reassembly after cleaning and inspection, and you will never have to waste time looking for pictures of the direction of assembly that aren't in most manuals. In every shop I have ever been in there is a typical delay between teardown and rebuild. The service writer must sell the job the customer. This may take a day or two. When the customer says yes, it takes a few days to get parts in most cases. Will you remember where the parts go three or four busy days later? Will Harry be able to rebuild the transmission Joe took apart before he left for vacation? Intelligent use of the die grinder eliminates all chance of error and saves incredible amounts of time.

As the shaft components are being removed, measure the endplay between the gears and surrounding parts and inspect every component for wear and damage. Try to keep key components in groups. Many modern units use different synchro rings for each gear. After cleaning and inspection, put the parts together with plastic ties; a mistake here will cause a comeback. At this stage we are looking for several things. The first is the root cause of the failure. The second is any broken or worn parts that should be replaced, and the third is to make sure that every part needed is listed on the estimate. Any parts that are missed and assumed good will have to be paid for with shop profits. Once the customer has agreed to a price, it will be worth your life to go back and ask for more.

Finding the root cause is more difficult and takes some experience. It is, however, the enjoyable part of the job and gives you a chance to play detective. There are some gearboxes that give up their secrets easily. One of the obvious ones is a failed bearing, pieces of which got between the teeth of gears in mesh with the resulting damage. Other failures are more subtle, a combination of wear and tear. Rounded coupling teeth on the speed gears, big chips and fractures in the reverse idler gear tell us that the owner drove this

trans with a clutch that didn't release properly for a time. The rear mainshaft bearing is 0.015 loose, the 1-2 shift fork has 0.010 sloppy fit into the slider, and first gear has 0.020 endplay on the main shaft. The coupling teeth are worn on the sides, losing the back taper. Adding up the excess tolerance gives us a negative clearance on the first gear of 0.035, and we can bet that this unit jumped out of first gear. With this knowledge we need to take a good look at the coupling teeth on the 1-2 synchro slider and add that to the other parts we need to replace. This is no place to be quick or casual. The time spent here will tell you how to fix all that is wrong with the unit and make sure the customer pays for all the damage to his transmission. You didn't break it, but if you miss a couple of expensive parts the job can break you.

It is easy to replace the parts once you know what parts to replace. Seventy percent of all comebacks on standard transmissions occur because damage or wear was overlooked on the teardown. The repair manual will show you where the parts should go, but no book can tell you what parts need replacing or why the unit failed. If we don't develop the expertise to learn from the unit, we are destined to work on it twice, and the second time is on us. **TD**

THE BOTTOM LINE:

Tell us your opinion of this article:

Circle the corresponding number on the free information card.

87 Useful information.

88 Not useful information.

89 We need more information.