

To Use or Not to Use

What Is a Good Gear?

By Mike Weinberg
Contributing Editor

Decisions, decisions! Every day we must make judgment calls on which parts to replace in the course of repairing a transmission or transfer case. These judgment calls are not to be taken lightly, as they have a tremendous effect on many areas of our business.

If you use a part that should have been replaced and it fails under warranty, the cost of labor and the parts to make the unit right are all on the shop and the job becomes a direct loss to your bottom line. On the other hand, transmission hard parts are expensive, and if you are replacing parts that could be reused, you will bring the cost of the repair beyond

what you can get the customer to agree to, and you lose the job to the junkyard or your competition. In effect, we are always walking a tightrope without a safety net.

Let's try to shed some light on inspecting geartrain and how to minimize risk and maximize profits.

Inspecting gears: In the daily press of business it is easy to do a less-than-thorough inspection of a unit that is being disassembled. To start with, making up a detailed form that notes all conditions that were noticed on the initial road test would simplify matters and enhance communication between employees. This makes the teardown technician


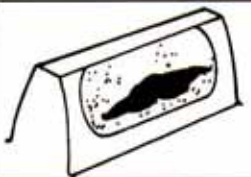
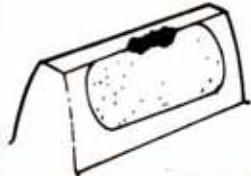
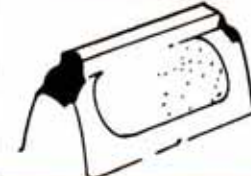

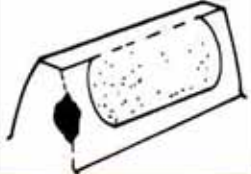
aware of the concerns that the customer had and that the test driver saw when driving the vehicle.

If you've read one of my past articles, you will remember not to pull the trans out of the car until you have isolated the cause of the problem, noise, vibration etc. Obviously, there are conditions that will prevent this, such as vehicles that come in on the end of a wrecker and cannot be driven. It still is important to start the car and put the trans through all ranges and get as much info as you can. Is it full of lube? Is it the right lube? Is the problem clutch related? Are any obvious problems visible on the driveline?

For example, a car you tow in has a clutch that is shot and the vehicle is undrivable. You do the clutch repair and now the trans is noisy. The customer will, in most instances, say something like, "It never did that before," and you are between a rock and a hard place. Make it a house rule that any vehicle towed in that is not drivable gets at least a mild internal transmission inspection.

Case in point: The clutch is inoperative because the trans puked all the oil out the front seal and soaked the friction material. If you just fix the clutch, you leave yourself wide open for a trip to consumer affairs. The hour you spend separating the trans cases will save you 10 hours of aggravation and

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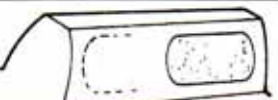



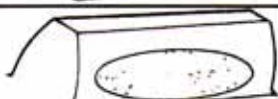

Chip Patterns			
Repair		Reject	
Corner Chip At Drive Face		Chip Within Contact Pattern	
O.D. Edge Chip At Drive Face May Extend Slightly Into Contact Pattern		Chip Completely Through Tooth (Considered To Be Broken)	
Corner Chip At Coast Face			
Side Edge Chip At Drive Face			

probably give you a healthier repair order.

There is no human on earth who can see through dirt and oil. If that statement makes sense to you, then you will realize that once you get the trans apart, it needs to be cleaned thoroughly and then inspected. Some tools would be useful at this point, and they should include a good light source and a magnifying glass. Many times you will need to inspect the contact faces of the gears for cracks, pitting and obvious wear points that you will not pick up without some magnification and a good bright light. These are the little flaws that turn out to be noises and breakage failures under warranty that are a huge waste of money and labor. Resist the temptation to rush this process, because that is where many costly mistakes are made. If you miss something and don't include the part on the estimate, you probably will pay for it out of your pocket. I have yet to meet a service writer who can reopen an estimate and tack on expensive parts after the customer has agreed to the original repair price.

Grading gears: The charts I have included will help you determine when to reuse a gear and when to replace it.

First, let's qualify some of this information into general methods of

Contact Patterns		
Description	Accept	Reject
Desired Contact Pattern		
End Contact Pattern		
Traveling Contact Pattern (Moves From Side To Side)		
High Contact Pattern		
Low Contact Pattern		

staying ahead of the problems.

Black-and-Blue Gears: Any time you open a unit that was run out of oil, understand that there is a good chance it might not pay to repair it. Any gear that is "black and blue" has undergone enough heat to change the molecular strength of the steel. It usually takes about 850° F to get that nice blue case-hardened color on a gear. At that point the material will lose its heat treat and become either soft or brittle, depending on the alloy. Reuse at your own risk, as noise and failure probably will result.

Broken Gears: A common scenario is to open a gearbox and find one or more broken gears. Gear breakage is due to three main causes: shock load, foreign bodies caught in mesh, and

defect in material. Defective material is very rare on units with mileage. A defect in manufacture usually shows up under the OEM warranty period. With gears that are shock-load or foreign-body victims, always replace both the gear that broke and the opposing gear. It is only logical to assume that whatever tons of force was required to shatter one gear was applied equally to the opposing gear. Even though one gear appears to be good, you cannot see internal stress fractures that will show up later. You have only one chance to sell the customer what he needs, and if you don't take it the comeback will be on your back.

Nicks and Chips: If you follow the charts, you will see various chips and

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nicks that are serviceable. Generally any chip that is not in the contact face of the gear can be smoothed out with a die grinder or a Dremel tool and reused. You occasionally will see new gears with minor nicks picked up in handling that can be treated the same way with no bad effects. Any gear with chips, pitting or cracks on the contact face should be scrapped. Here is where the magnifying glass comes in. Look for abnormal wear patterns on the contacts faces. Heavy gouge marks, strange patterns or flaking material will cause noise and early failure.

Coupling-Teeth Problems: Most speed gears have two sets of teeth – the helical teeth, which we have talked about, and the coupling or shift teeth. Examine the coupling teeth carefully, as they control shift quality. The pointed surfaces of the teeth should be sharp with no flattened, rounded, or broken or chipped points. This will cause a hard, grinding shift. Don't forget to look at the inside of the synchro slider, which will mate with the coupling teeth and have the same damage.

Now inspect the sides of the coupling teeth, which are cut with a few degrees of back taper. It is this angle on the sides of the coupling teeth that holds the slider in gear. If the sides are worn shiny and relieved, gear jump-out will occur.

A word about repointing teeth: I have seen many instances in which someone who is good with a die grinder repointed the teeth in an

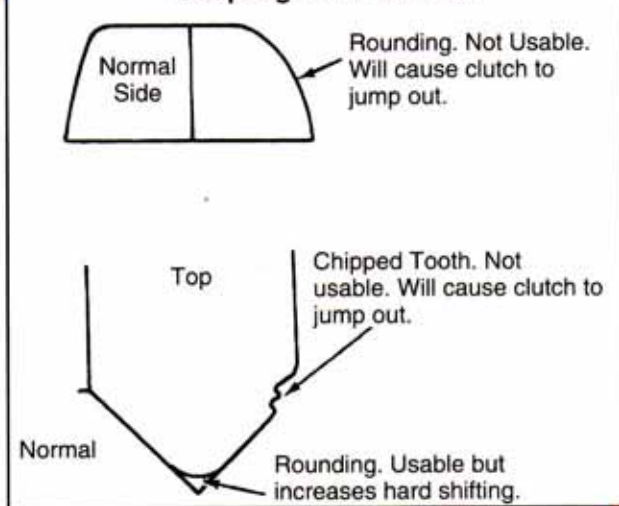
effort to save the gear. This will be a short-term fix. The heat treat that hardens the steel in the gear usually is no more than 0.030 inch deep. Grinding the tooth back to a correct shape will take the tooth back to virgin metal, which is too soft to have a good life expectancy.

Gear-Contact Patterns:

Understanding why the contact pattern on the tooth face is critical and what it can tell you is important. As the trans is used, wear and tear are inevitable. The bearings hold the shafts on a centerline in the trans that is concentric with the engine crankshaft.

As bearings and thrust washers wear, endplay, preload and parallel specs all change. If you get a unit that has been run for a period of time with a bad bearing, that shaft no longer is running on the centerline. This causes the contact face of the gears to run at different angles from those they were made for, and increased wear occurs on the gear face. I get many tech calls from shops that have replaced all the bearings in a transmission but the unit still is noisy. Once the bearings are replaced and the shafts are back on center, the wear on the contact face of the gear no longer is true and you get gear whine. If you refer to the chart on contact patterns, you will see side-to-side and high-or-low patterns that occur because of the gears

Coupling-Tooth Defects



moving off centerline.

The time spent patiently examining the geartrain is not a waste. On the contrary, it is the beginning of a successful, profitable repair. Remember the old saying, "How come there is never enough time to do it right, but there is always time to do it over?" **TD**

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