FOUR-SPEED MANUAL TRANSMISSION
The Shift to Manual Shift

A few years ago it seemed that manual transmissions were destined to suffer the fate of the now extinct Dodo bird. More recently, manual transmissions in general and “Four-On-The-Floor” in particular have enjoyed a resurgence of popularity. All evidence now points to the probability that you’ll be servicing an increasing number of these four-speed boxes for some time to come.

The first part of this reference book literally takes you inside the transmission and introduces you to all the gears, shift mechanisms and shafts. The film covers the power flow for each gear range so you’ll have a clear understanding of which gears and parts are involved every time gears are shifted. It also takes time to explain the operation of the synchronizer mechanisms so you’ll be better equipped to diagnose synchronizer problems.

The second part of the book deals with the shift linkage . . . from the shift forks inside the transmission to the shift lever in the passenger compartment. This includes an explanation of the interlock between the 1-2 and the 3-4 shifters. It also explains the reverse idler and the reverse shifter as well as the unique mechanical interlock device used between the 1-2 shifter and the reverse shifter. You’ll find the information on shift linkage adjustment particularly timely and valuable. Whether or not you are a transmission specialist, you’ll find all the information in this reference book worthwhile.

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At first glance, a manual transmission is a mighty complicated looking assortment of parts packed into a relatively small space. And of course, a four-speed transmission is just a bit more complex than a three-speed job. If you happen to be an old experienced hand on manual transmission service and repair, you probably know all those gears and synchronizer parts like the back of your hand.

Once you’ve disassembled and assembled a few of them, you’re bound to have a pretty good idea of how all the parts fit together and how they work. However, since overhauling a four-speed manual transmission isn’t the sort of job that comes along very often, the majority of you master technicians probably haven’t had a chance to get acquainted with a four-speed job the hard way... by overhauling a few. In the next few pages we’ll introduce you to the working parts the easy way... by explaining power flow in each gear.

MEET THE MAJOR PARTS

Inside the transmission you’ll find eleven gears, or more exactly, eleven sets of gear teeth. To simplify things, let’s break your introduction to these gears down into three major groups or subassemblies. For the time being we’ll ignore the reverse idler gear and concern ourselves with the gears involved in the four forward speeds.

The main drive pinion is at the front of the transmission. Behind that is the mainshaft assembly with its gears and synchronizers. Below this is the countershaft gear... more commonly known as the cluster gear.

THE MAIN DRIVE PINION

All power input to the transmission is through the main drive pinion. The car’s clutch couples the drive pinion to the engine when it’s engaged and disconnects the transmission from engine power when it’s disengaged. As you can see in the accompanying illustration, the main drive pinion gear is always meshed with the cluster gear.

THE MAINSHAFT ASSEMBLY

The mainshaft is the power output shaft. The mainshaft assembly includes the first-, second- and third-speed gears. It also includes the two synchronizer assemblies.

In all ranges except fourth gear, there is no direct mechanical connection or coupling between the main drive pinion and the main-
shaft. The front end of the mainshaft is piloted or supported in roller bearings in a pocket in the pinion gear. That means that the pinion and the mainshaft turn independently except when they are coupled in fourth-gear.

Before you can begin to understand power flow you must understand which parts are always connected to the mainshaft and which parts are not. When the transmission’s in neutral, the three helical gears on the mainshaft are free to turn. In other words, they are not coupled or mechanically connected to the mainshaft.

The two synchronizer assemblies are always mechanically connected to the mainshaft. In neutral they are not connected to any of the helical gears on the mainshaft. The synchronizer assemblies, which include the clutch sleeves, always turn when the mainshaft turns. Incidentally, those spur gear teeth on the clutch sleeve at the rear of the transmission are part of the reverse gear train. Until we get around to discussing power flow in reverse, we’ll simply ignore those spur gear teeth.

THE CLUSTER GEAR

It’s easy to see where the cluster gear got its name! This one-piece gear has four sets of helical gear teeth and one set of spur gear teeth. It’s literally a cluster of gears, or to be more precise, five gears in one.

Earlier we called attention to the fact that the main drive pinion is always in mesh with the cluster gear. That means the cluster gear always turns when the pinion gear is turning. We also pointed out that the helical gears on the mainshaft are not coupled directly to the mainshaft. As a result of this, the cluster gear can turn the helical gears on the mainshaft without transmitting any power to the mainshaft. That’s exactly what happens when the transmission’s in fourth or neutral.

CLUTCH SLEEVE SHIFTING

Just about everybody refers to changing speeds as, “shifting gears”. Except for reverse, it’s the clutch sleeves and not the gears that are shifted. All forward speeds are obtained by shifting the clutch sleeves either forward or rearward.

HOW THE CLUTCH SLEEVES COUPLE

The clutch sleeves are splined to the mainshaft. Actually, the clutch sleeves are splined to
clutch gears which are in turn splined to the mainshaft. That means each clutch sleeve is always mechanically attached to the mainshaft. Of course the splined connection between the clutch sleeve and the mainshaft allows the sleeve to be shifted back or forth.

The clutch sleeve splines have another important function. The internal splines of the clutch sleeve match short external splines on the main drive pinion and on the hub of each of the three helical gears on the mainshaft. The accompanying illustration shows how the splines of the three-four clutch sleeve match the short spline teeth of the main drive pinion. This same coupling arrangement is used at each of the helical gears on the mainshaft.

In order to simplify things, we'll confine our discussion of power flow to an explanation of what's connected to what in each speed range without complicating things by trying to explain which speed range we shifted out of.

**FIRST-GEAR POWER FLOW**

In first gear, commonly called low, the one-two clutch sleeve has been shifted toward the rear of the transmission. The clutch sleeve couples the first-speed gear to the mainshaft. The three-four clutch sleeve is in neutral. The power flow is from the main drive pinion to the cluster gear, from the cluster gear to the first-speed gear and out through the mainshaft.

**SECOND-GEAR POWER FLOW**

In second gear, the one-two clutch sleeve has been shifted forward . . . toward the front of the transmission. The clutch sleeve couples the second-speed gear to the mainshaft. The three-four clutch sleeve is in neutral. The power flow in second is from the pinion gear to the cluster gear. Then, from the cluster gear to the second-speed gear and out through the mainshaft.

**THIRD-GEAR POWER FLOW**

In third gear, the three-four clutch sleeve is shifted toward the rear of the transmission. This couples the third-speed gear to the mainshaft. The one-two clutch sleeve is now in neutral. The power flow is main drive pinion to cluster gear and third-speed gear to mainshaft.

**FOURTH-GEAR POWER FLOW**

In fourth gear, the main drive pinion is coupled directly to the mainshaft. This is accomplished...
by shifting the three-four clutch sleeve forward. Here, too, the one-two clutch sleeve is in neutral. Engine power comes in through the drive pinion and goes out through the mainshaft without any change in speed or torque. That’s why it’s sometimes called direct drive.

**THE REVERSE IDLER’S A LAZY GEAR**

Unlike the forward gears in our transmission and the reverse gears in most transmissions, our reverse idler never turns until you shift into reverse. The reverse idler gear is a sliding spur gear. To shift into reverse, you simply slide the reverse idler into mesh with the spur gear teeth on the one-two clutch sleeve and the spur gear teeth of the cluster gear. Of course, both the one-two clutch sleeve and the three-four clutch sleeve must be in neutral when you slide the reverse idler into mesh with these spur gears.

**THE REVERSE IDLER’S BACKWARD, TOO**

In first, second and third, three gears get into the act to change speed and multiply torque. Of course in all forward gear ranges the main drive pinion and the mainshaft rotate in the same direction...clockwise as viewed from the front. In reverse, four gears get into the act. This reverses the direction of rotation of the mainshaft and the car backs up.

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**SYNCHRONIZATION**

The four-speed manual transmission is synchronized in all forward speeds. That means you can upshift or downshift between any two forward gears without clashing gears. Perhaps it would be more accurate to say that you can shift between any two forward speeds without clashing clutch sleeves. Remember? It’s the clutch sleeves that do the shifting by coupling a clutch sleeve to one of the helical gears, or to the main drive pinion.

**WHY IS SYNCHRONIZATION NECESSARY?**

Let’s take time to recall why we need synchronizers. Suppose the transmission’s in neutral, the engine’s running, and the car’s standing still. The main drive pinion is turning the cluster gear and the cluster gear is driving all of the forward speed gears on the mainshaft. However, since both clutch sleeves are in neutral, none of these gears are coupled to the mainshaft, so no power is transmitted to the
mainshaft. Next, let’s see what happens when we shift into first gear.

The first thing we do on a shift is disengage the clutch. This disconnects the transmission from the engine. However, the main drive pinion, the cluster gear and the helical gears on the mainshaft will freewheel and coast to a stop after the clutch is disengaged. Since the car is not moving, the mainshaft is not turning. That means the clutch sleeves are not turning. Now suppose the clutch sleeves are not equipped with synchronizers. If you shift the one-two clutch sleeve rearward to couple it with the first-speed gear, the internal splines of the clutch sleeve will ratchet against the spline teeth of the rotating first-speed gear. This ratcheting, or clashing, will continue until the first-speed gear coasts to a stop.

On virtually every upshift or downshift the clutch sleeve will be turning either faster or slower than the gear selected. On upshifts, the next higher gear will usually be turning faster than the clutch sleeve. On downshifts, the lower gear will usually be turning slower than the clutch sleeve. That’s why synchronizers are needed to prevent sleeve-to-gear clashing on all upshifts and downshifts.

**SYNCHRONIZERS DO TWO JOBS**

A synchronizer unit must perform two functions in order to provide clash-free shifting. It must momentarily stop or block the shift until the clutch sleeve and the gear selected are both turning at the same speed. It must quickly slow down or speed up the gear selected to match the speed of the clutch sleeve. The synchronizers actually do both of these jobs simultaneously and very quickly to provide smooth, fast shifts completely free of clashing.

**MEET THE SYNCHRONIZER PARTS**

You already know that there are two synchronizer assemblies. The one-two synchronizer at the rear of the transmission takes care of all shifts into first and second gears. The three-four synchronizer at the front synchronizes shifts into third and fourth gears. Since these synchronizers all work the same way, we'll only have to explain how one of them works.

The accompanying illustration shows the main functional parts of the three-four synchronizer assembly. First, there is a bronze stop ring. You may know it as a synchronizer or a blocker ring. These are both common names for the stop ring. Next comes the clutch gear and the three shift plates. Because of these shift plates, this particular type of synchronizer is sometimes called a plate-type or strut-type synchronizer. Finally, there is the clutch gear sleeve. We introduced you to it earlier by the simple name of clutch sleeve.

**ASSEMBLING THE SYNCHRONIZER ASSEMBLY**

Before we explain how the synchronizer works, we had better explain how the synchronizer parts fit together. The shift plates fit into wide spline-like notches in the clutch gear. The clutch gear and shift plates slide into the internal splines of the clutch sleeve. In the accompanying illustration you can see that clutch
The clutch gear has internal splines which key it to matching splines on the mainshaft. A snap ring locks the clutch gear in place so that it becomes a part of the mainshaft. Incidentally, the only reason the clutch gear is designed as a separate part is to permit installing the second-speed and third-speed helical gears on the mainshaft.

**SHIFTING INTO FOURTH GEAR**

As we said earlier, all forward speeds are synchronized. Since the action of each of the synchronizers is the same, you will understand them all if you understand one. Here’s what happens on a shift into fourth gear.

On an upshift into fourth the three-four clutch sleeve must be shifted forward until it couples the mainshaft to the main drive pinion. On this upshift the main drive pinion is turning faster than the clutch sleeve. It must be slowed down so that it is turning at the same speed as the clutch sleeve. In other words, the speeds must be synchronized.

**THE STOP RING BLOCKS THE SHIFT**

When the driver starts to shift into fourth, the stop ring is pushed toward the cone-shaped shoulder of the drive pinion. The inner surface of the stop ring is cone-shaped, too, so these two surfaces form a cone-type clutch. The conical inner surface of the stop ring has thread-like grooves cut into it. These grooves break through the lubrication film on the conical surface of the pinion and speed up the synchronizing action. If, through abuse, these grooves are worn smooth, the stop ring will not work effectively.
At the beginning of the shift, the ends of the shift plates push the stop ring into contact with the conical surface of the pinion gear. When the stop ring contacts the faster moving pinion, friction between the two causes the stop ring to speed up momentarily. In the process of speeding up, the stop ring does rotate slightly until it is stopped by the shift plates. This slight movement of the stop ring is sometimes referred to as “clocking”. We stated earlier that the slots in the stop ring are wider than the plates. They are made wider to permit the ring to “clock”.

![Stop ring rotation stopped by shift plate](image1.png)

The shift plates control the “clocking” of the stop ring so that the ends of the internal teeth in the clutch sleeve push directly against the stop ring teeth. This momentarily blocks the shift so that the clutch sleeve splines are not pushed into contact with the faster turning spline teeth of the main drive pinion. That’s why the stop ring is often called a blocker ring.

**THE STOP RING SYNCHRONIZES**

Since the shift plates fit into notches in the stop ring, the stop ring rotates at clutch sleeve speed. At the same time the clutch sleeve continues to push the stop ring against the conical surface of the main drive pinion. Friction soon slows the pinion down so that it is turning at the same speed as the clutch sleeve. When this happens there is very little torque load on the stop ring. The chamfered ends of the sleeve teeth nudge the chamfered ends of the stop ring teeth slightly sidewise. This lines up the teeth so the clutch sleeve can slip past the stop ring teeth.

When the stop ring lines the sleeve splines up with the spline teeth on the drive pinion, the sleeve and pinion are turning at the same speed . . . speeds are synchronized. The sleeve slips over the teeth on the pinion, coupling it to the mainshaft to provide direct drive through the transmission.

![Sleeve couples pinion to mainshaft](image2.png)

**THE OTHER FORWARD SPEEDS**

Synchronization for first, second and third works the same as for fourth gear. Here are a few things to keep in mind when diagnosing shift or synchronization problems. Remember that mainshaft and both of the clutch sleeves are always being driven at driveshaft speed by the car’s rear wheels. That means that sleeve speed changes very little when you upshift or
downshift. What does change is the speed of the main drive pinion, the cluster gear and the helical gears on the mainshaft. The speed of these gears must be increased or decreased to match mainshaft speed on every shift into a forward speed range. That's why complete clutch disengagement is important to smooth shifts. Partial disengagement leaves a stop ring fighting both the engine and the rear wheels, and a stop ring is just not big enough to fight in that league. Failure to completely disengage the clutch will damage synchronizer parts.

![The Shift Mechanism and Linkage](image)

So far we have explained what happens when the clutch sleeves and reverse gear are shifted. In this section we'll cover the mechanisms that shift these parts. It will be easier to do this if we break the explanation down into two parts. First, we'll cover the shift mechanisms inside the transmission. Then, we'll cover the shift linkage leading to the operator's gearshift lever... the shift "stick".

**Shifter Mechanisms**

Shift forks are used to move the clutch sleeves and the reverse idler gear. This is standard design practice on virtually all manual transmissions and should need no further explanation. However, the shifters and levers that move the forks do deserve further discussion.

**The Gearshift Control Housing**

The parts that control the movement of the shift forks are called shifter shafts. Both the one-two and the three-four shifter shafts are part of the gearshift control housing... more commonly called the cover assembly.

An interlock device between the two shifter shafts prevents accidental shifting into two forward gears at the same time. When servicing the shifter shafts or cover, be careful not to lose the detent ball pin. If you assemble the interlock without that pin, the detents will work all right but the interlock won't, and it will be possible to shift into two forward gears at the same time.

**The Reverse Shifter Lever**

The reverse shifter lever is assembled into the transmission case rather than into the cover. Its primary job is to control the reverse shift fork; however, it also prevents an accidental shift into reverse when the transmission's already in first or second. Here's how that works.
When the transmission is already in first gear, a cam-like extension on the reverse shifter hits the one-two shifter. This keeps the reverse shifter from moving and prevents an accidental shift into reverse when in first gear.

When the transmission is in second, you can’t shift into reverse accidentally because of interference between the reverse shifter cam and the one-two shifter.

The cam on the reverse shifter performs another function. If it were not for that cam, the reverse idler gear teeth could butt head-on into the ends of the spur teeth of the one-two clutch sleeve gear. This could bump the sleeve rearward . . . right into first gear when shifting into reverse. Thanks to the cams on the reverse and one-two shifters, this can’t happen. On a shift into reverse, the reverse shifter cam slides into contact with the cam surface of the one-two shifter before the reverse idler gear starts to mesh with the spur teeth on the clutch gear sleeve. This prevents the clutch sleeve being bumped and accidentally coupled to the first-speed gear.

The reverse shifter cam does one more important thing. Once you complete a shift into reverse, the close fit between the two cam surfaces of the shifters holds the one-two clutch sleeve exactly in neutral. This eliminates any possibility of the one-two clutch sleeve shifting enough to allow a stop ring to drag and wear out prematurely.

**THE COVER ADJUSTS THE CAM FIT**

Since the one-two shifter is located in the cover and the reverse shifter is in the transmission case, the cover location determines the fit between the two shifter cam surfaces. Correct cover adjustment is very important and should be performed as follows.

**Assemble cover to case:** Put the reverse shifter lever in reverse and the one-two and three-four shifter levers in neutral. Attach the cover to the transmission case but leave the attaching bolts just barely snug . . . so that the cover can be shifted by tapping it.

**Tap cover downward:** Tap the cover downward . . . toward the reverse lever. This will move the cam surface of the one-two shifter into contact with the reverse shifter cam surface. This should give you a pretty good initial adjustment.
Remove reverse detent plug: Remove the reverse detent plug to relieve the drag of the detent ball on the reverse shifter. Don’t accidentally unscrew the detent spring retainer or the detent ball will drop into the transmission.

Test cam and cover adjustment: Move the reverse shift lever an inch or so in each direction. You should feel a definite drag between the reverse shifter cam and one-two shifter cam.

Check for reverse shifter interference: Test reverse lever travel from its neutral to its reverse position. You should feel a drag but the fit must not be tight enough to block the reverse shifter out of reverse. If it is too tight, carefully readjust the cover.

One-two shifter shaft fit

The one-two shifters are a selective fit. Shifters are marked “A”, “B” or “C”. The distance from the shaft to the cam surface of an “A” shifter is less than the distance from shaft to cam on a “B” shifter. On a shifter marked “C” the shaft to cam distance is still greater.

If you ever have to replace a one-two shifter shaft be sure to install the correct one. Or if you install a new cover, you may have to install a new shifter shaft in order to get the correct cover adjustment. For example, if an “A” shifter won’t let you adjust the cover to get a slight drag against the cam surface of the reverse shifter, try a “B” or maybe a “C” shifter. On the other hand, if a “C” shifter blocks the shift into reverse you may have to install a “B” or an “A” shifter.

External shift linkage

It is impossible to overemphasize the importance of correct shift linkage adjustment. The entire shift linkage ... all three shift rods ... must be adjusted carefully and accurately for several reasons. If either clutch sleeve is mispositioned more than about a sixteenth of an inch, it may push on a stop ring when it should be in neutral. If a shift rod is adjusted too long or too short, it will cause a stop ring to drag and wear out prematurely. In addition, it doesn’t take much misadjustment of the shift rods to cause a rough crossover condition and poor shift quality.

Shift rod adjustment

Disconnect the shift rods from the shift levers at the transmission. Make sure the three shift levers are in neutral. Then, back off the stop screws ... you’ll readjust them later.

Install special tool C-3951 on the shift assembly with the center pin extending through the first two levers. Tighten the tool set screw securely. This aligns the three gearshift control levers and holds them in neutral.

Adjust each shift rod as carefully and accurately as possible. Turn the shift rod or the swivel to adjust the effective length of the rod. Rod length is correct when you can slip it into its hole in the shift lever without moving the lever even slightly out of its neutral detent position.

Test shift rod adjustment

Remove the aligning tool and check the ac-
accuracy of the adjustment by shifting into all gear ranges several times. Make sure the cross-over shift action is smooth. There should be no roughness or bumping going from the three-four range to the one-two range or going through the crossover between reverse and the one-two range. If you feel a crossover bump you will have to readjust at least one rod. Here's why that may be necessary even though you have used the special aligning tool.

You have to adjust each rod in steps of one full turn but sometimes one-half turn gives you correct rod length. In a case like that you have to adjust it another half turn so that you can assemble it to its lever. A half-turn extra in one direction will make the rod a bit too long and a half turn the other way may make it slightly too short. If you guess wrong and make that extra half-turn in the wrong direction, you may get a slight crossover bump. Usually, a one-turn realignment of the reverse rod will clear up a slight crossover bump between reverse and the one-two range.

GEARSHIFT CONTROL LEVER STOP SCREWS

You've probably noticed that on some models the gearshift control lever assembly is not equipped with stop screws. Other cars, particularly those equipped with higher powered engines, do have gearshift stop screws.

The main function of the stop screws is to keep the driver from pushing the shift lever too far and too hard. Too much force could bend the shift rods and even crack the shift cover. Actually, the two shift lever stop screws aren't too important on normal, sensible shifts. When properly adjusted, they do keep hot rodders and speed shifters from slamming the shift lever too far when shifting.

STOP SCREW ADJUSTMENT

Never adjust the stop screws until you have completed your adjustment of the shift rods. With the gearshift lever in fourth, turn the front stop screw in by hand until it just touches the shift lever. Then, back off the stop screw one-half turn and lock up the adjustment by tightening the lock nut. The rear stop screw is adjusted the same way but the shift lever must be in third when making this adjustment.

Fig. 26—Adjust stop screws after adjusting rods

The appropriate service manuals and service bulletins cover the servicing and repair of the four-speed manual transmission. There is no need to repeat the assembly and disassembly information contained in these service publications. However, from time-to-time service parts are changed and new service tips come along. In this section we'll cover some of the most important changes and service tips.

DRIVE PINION WITHOUT OIL SLINGER

If you disassemble a transmission and find no oil slinger on the main drive pinion, don't be alarmed, it's supposed to be that way. Late-type pinions have a thicker thrust face which takes the place of and does the same job as the oil slinger used on early production pinions. Early- and late-type pinions can be used, in-
interchangeably, but in no case should an oil slinger be used with a late-type pinion. If it is, the transmission won’t go back together right. The late-type pinion is easily identified by the thicker, larger diameter thrust face which functions as an integral oil slinger. Early-type pinions should continue to be serviced as in the past, using an oil slinger.

NEW ONE-TWO SHIFT FORK
The 1-2 shift fork has also been improved. The new- or late-type is easily identified since it goes half way around the one-two clutch sleeve. This reduces the tendency of the shift fork cocking in the sleeve. If you are having shifting problems that can’t be fixed with a careful linkage adjustment, install the new-type fork.

SNAP RING TOOL
Unless you happen to have three hands, you’ve probably had trouble compressing the center bearing snap ring with a pair of pliers, while separating the mainshaft assembly from the extension housing. To make the job easy, make a simple snap ring tool from a piece of 3/8” copper tubing. About six inches is a good length, and one end should be formed into a rectangular shape.

The rectangular end of the tool is slipped over the tangs of the snap ring, compressing it out of the groove in the extension housing. This, of course, frees both hands for separating the mainshaft from the extension housing.

REVERSE SLIDER GEAR SHAFT REMOVAL
It is sometimes difficult to remove the reverse slider gear shaft using a drift and hammer.
Here's a good trick that makes pushing that shaft out quite easy. Use either a C-3638 Power Steering Worm Shaft Seal Remover or a C-3642 Pump Shaft Remover. Assemble a 3/8” or 1/4” drive 7/16” socket to the puller screw. Position the puller and socket as shown and turn the hex end of the puller to push the reverse gear shaft from the case.

INSTALLING SNAP RINGS
There are a couple of points about snap rings every master technician ought to know. Never install used snap rings. Even slightly bent or deformed snap rings have a tendency to work their way out of their groove, causing all sorts of problems . . . such as gear jump out and hard shifting. A snap ring can be badly stressed and still look all right. So don't take a chance on used snap rings. Avoid comebacks by always installing new snap rings. Don't ruin a new ring by expanding it any more than necessary. A new snap ring that's bent during installation is just as bad as an old snap ring.

SERVICE PRECAUTION
When assembling the mainshaft into the case, make sure that the fourth gear stop ring is correctly positioned so that the notches in the stop ring line up with the clutch sleeve shift plates. If this stop ring is not correctly indexed and you tighten the extension housing attaching bolts, you'll damage the stop ring. Follow the instructions in your service manual and make sure the stop ring is correctly indexed before tightening the extension housing bolts.

LUBRICATION
The fluid level should be checked twice a year and if necessary, recommended lubricant added until level with the bottom of the filler plug hole.

Type “A” Suffix “A” transmission fluid is a good year-round lubricant. Some customers expect manual transmissions to run quieter than they are designed to be. To please such a customer, Multipurpose Gear Lubricant as high as SAE 140 may be used. This will quiet the transmission, but in cold weather it causes high shifting effort.

For normal service, it is not necessary to change the lubricant at periodic intervals. For other than normal passenger service recommendations, refer to the Certified Car Care Schedule.

DIAGNOSIS OF ABUSE
If a manual transmission is properly lubricated and adjusted, about the only way to abuse one is by improper shifting. This can occur through bad driving habits, such as poor timing of clutch release and apply. Some hot rodders use the “stick” like a pry bar to speed up synchronization, or shift without clutching. In either case, it's the stop ring that takes the beating.

Remember, the stop ring delays completion of the shift, until the gear speeds are equal. This only takes a split second, but even that is too long for the boys who like to hurry it up by speed shifting. They try to either use the clutch very fast or not at all, and try to jam the clutch sleeve right past the stop ring. This usually results in battering the stop ring teeth out of shape, cracking the stop ring or wearing off the grooves on the inner cone of the ring. Since the grooves speed up the synchronizing, the smoother they get, the longer it takes to shift. The speed shifter has to jam the clutch sleeve even harder to achieve a shift as quickly as he wants it. Finally, teeth are worn to the point where even more serious problems and damage develop.