

DISASSEMBLY OF THE 5-SPEED GEARBOX

- 1) Loosen the square drive drain plug. A 1/2 inch drive ratchet works satisfactorily here. Drain the oil. Note that because of the very high viscosity of the oil it will drain very slowly. Under 40° F. it almost doesn't drain at all. Carefully examine the residue on the drain plug magnet since this can give you insight into the condition of the gearbox internals. VERY, VERY, VERY minute 'pixie dust' is considered normal. If you start finding pieces the size of a pencil point, be ready for serious trouble. If you let it drain overnight you can get most of the oil out. Clean the magnet thoroughly and replace the plug before continuing.
- 2) Remove the four bolts securing the short driveshaft section to the rear flange of the gearbox. Inspect the u-joint for looseness, roughness, or damage. Replace it if necessary, following the instructions in the section on DRIVESHAFT REPAIR.
- 3) Remove the cotter pin from the castle nut securing the driveshaft flange. Some cars are equipped with only a large locking nut with no cotter pin. You usually have to clamp the flange in a vise to hold it securely. A LARGE pair of channel locks on the flat sides of the flange sometimes works if you have a helper. Remove the nut and flat washer. Lightly tap the edges of the flange toward the rear to slide it off the shaft splines. Use a gear puller if necessary. DO NOT JUST BEAT UP THE FLANGE WITH A HAMMER. It will make it difficult to refit the driveshaft.
- 4) Remove the two large bolts securing the rear rubber gearbox mount.
- 5) Remove the two large hex plugs from the bottom of the tailshaft housing and extract the select springs and plugs. You may need a thin mechanic's magnet to get them out.
- 6) Remove the c-clip and pin securing the shift arm to the striker rod on the top side of the gearbox. Remove the eight bolts securing the tailshaft housing to the assembly plate.
- 7) Tap the tailshaft housing rearward to separate it from the assembly plate. It may fit tight because of the two locating dowels or gasket sealer on the gasket. IT IS AN ALUMINUM CASING. BE VERY CAREFUL WHERE YOU HIT IT AND HOW HARD YOU HIT IT. Use wood blocks between the casing and the hammer if you must hit it repeatedly.
- 8) Remove the oil seal and bearing from the rear of the housing. Discard the seal. Clean the bearing with CLEAN solvent and inspect it for any roughness or jamming. Dirty solvent can easily contaminate the bearing with dirt and/or grit. The bearing must be absolutely smooth and free-turning. Oil the bearing before storing it for reuse. Store it in a place where it will see NO dirt or dust.
- 9) Pull out the striking rod from the front of the tailshaft housing (if it hasn't already fallen out). Remove the rear o-ring and cap. Use a suitable bushing driver to drive the striking rod bushing out the tailshaft housing working from the INSIDE of the casing. You only need to drive it back to the rear-most aluminum boss before the shifting arm will drop off. Remove the shifting arm and inspect for wear, particularly on the underside of the 'outriggers' since these are subject to extreme wear by the select pins. This wear will cause sloppy gear lever movement. Replace the shifting arm if there are deep dimples in the 'outriggers'. Renew the o-rings, replace the shifting arm and drive the bushing back into the case leaving sufficient clearance to install the o-ring and cap in the rear aluminum boss. Install a new o-ring and cap.
- 10) Remove the speedometer drive gear by releasing the set bolt and retainer plate from the side of the tailshaft housing. Pull the drive sleeve out of the casing. Inspect the gear for wear and replace it if the teeth are damaged by driving the teeny split pin out of the side of the sleeve. If you replace the gear you can also renew the seal that is inside the sleeve. Replace the sleeve o-ring. Oil the o-ring, reinsert the sleeve, and secure the retaining plate with the set bolt.

- 11) Remove the ten bolts securing the bell-housing. Remove the bell-housing from the front of the gearbox. Catch and retain any shims that fall out the front from the bearings. These are VERY important.
- 12) Remove the large external snap ring from the front main drive bearing. Remove the center gearbox casing by tapping to the front. THIS IS AN ALUMINUM CASTING. BE CAREFUL WHERE YOU HIT IT AND HOW HARD YOU HIT IT. Do not hit it on the gasket surfaces. It also has two dowel pins to locate it and may have gasket sealer which will make the job more difficult. Use wood blocks to insulate the casing from your hammer blows if you must hit it repeatedly.
- 13) Remove all the shifting fork retaining pins using a suitable drift punch.
- 14) Remove the three checking plugs from the side of the assembly plate. Extract the springs and balls. Use a mechanic's magnet if necessary to get them out. The little balls have a tendency to roll all over your shop if they pop out later on their own. Get them out now!
- 15) Tap the shifting rods, one at a time, out to the rear being EXTREMELY CAREFUL NOT TO MUSHROOM THE TIPS. They are very soft steel and will mushroom under the hard blows of even a brass hammer. Use a plastic hammer or rubber mallet. Be gentle. To check if you have mushroomed them, reinsert them into their receptacles in the front of the center casing and see if they exhibit any tightness. They should be absolutely free moving. If they bind or jam they must be replaced.
- 16) Remove the four interlock balls from their holes (intersecting the shifting rod holes) in the assembly plate after the shifting rods are removed.
- 17) If you have a vise with soft jaw protectors, you can clamp the assembly plate in the vise to secure it for the rest of the operations. DO NOT VISE IT IF YOU RISK DAMAGING THE GASKET SURFACES. You can take a piece of 3/8 inch thick steel plate and drill some holes in it, bolt the assembly plate to IT and clamp the steel plate in the vise.
- 18) Remove the rear bearing, spacer ring and (in order from the rear) snap ring, snap ring, speedometer drive gear and ball, snap ring, snap ring, ball bearing, and snap ring. Use a press to extract the bearing and speedometer gear; beating on them with a hammer will cause damage. You can sometimes cheap out and use wood blocks - try to keep the splinters out of the bearing!
- 19) Operate the 1st/2nd and 3rd/4th coupling sleeves by hand and lock the geartrain into two gears SIMULTANEOUSLY.
- 20) Release the tab(s) on the locking plate (if one is installed), remove the rear nut(s), the lock plate, the thrust washer and ball. If all is well, this nut will be very tight.
- 21) Remove the bolt from the rear of the countershaft and use a puller to remove both the bearing and overdrive gear. Be careful not to chip the gear teeth when pulling.
- 22) Remove the 5th speed gear from the mainshaft, the two roller bearings and the bearing sleeve. Inspect the bearings and sleeve for nicks, marks, or roughness. Replace if any defect is noticed.
- 23) Remove the HEAVY snap ring securing the reverse idler gear, remove the thrust washer, gear, and bearing. Remove the large locking nut and washer from the idler shaft. Remove the set pin that is inserted in the side of the assembly plate to free-up the idler shaft. Tap the shaft out of the assembly plate to the rear.
- 24) Remove the reverse main gear and reverse main gear hub from the mainshaft. Remove the reverse counter gear from the countershaft; you may need a puller for this. Oil the splines if you need a little help.
- 25) Remove the six phillips head screws securing the mainshaft bearing retainer on the assembly plate. Remove the plate. Catch and retain any shims that are on the countershaft bearing.
- 26) Lightly tap the mainshaft REARWARD far enough to expose the external snap ring on the mainshaft bearing. Remove the snap ring.
- 27) Lightly tap BOTH the mainshaft and countershaft FORWARD until both shafts fall clear of the assembly plate. The bearings should stay on the shaft and slide out of the plate. DO NOT LET THE

SHAFTS FALL ON THE FLOOR SINCE THE GEAR TEETH CHIP EASILY. It pays to have a 'third' hand available since the input shaft will also fall free during this operation.

- 28) Use pullers to remove both remaining countershaft bearings. Remove the snap ring and shim from the input shaft and pull that bearing also. A press is the ideal tool for this if you have one available.
- 29) Use a puller (or press) to remove the main drive bearing from the center of the mainshaft. Remove the thrust washer and ball.
- 30) Remove the 1st speed gear, bearing and bearing sleeve. Remove the coupling sleeve and sleeve hub. Remove the 2nd speed gear and the bearing.
- 31) Remove the snap ring securing the coupling sleeve hub to the FRONT of the mainshaft. (By now the coupling sleeve itself should have fallen off.) Remove the hub, 3rd speed gear and bearing.

INSPECTION OF PARTS

Thoroughly clean all parts in clean SAFE solvent. Keep the bearings separate and use really clean solvent. Inspect all gear teeth for chips, cracks, or missing pieces. Inspect all coupling sleeves for worn inner teeth or scoring from the shifting forks. Inspect all synchronizer rings and their coupling teeth. Check all roller bearings for chipped or scarred rollers. Check all ball bearings for roughness or jamming. Check all thrust washers and thrust surfaces for excess wear or scoring. Inspect all shifting forks for wear on the tips, especially 'blueing'. Check the striking rod for ovality in the retainer pin hole.

Remove the large circlip from each gear (servo synchro only) and inspect the synchro ring, brake bands, thrust block and anchor block. Replace these parts if any noticeable wear is present.

Check 5th speed gear to see if it is the splined type. If it is not, discard it regardless of condition and replace it with one of the splined type. The unsplined versions can fail AT ANY TIME even if they LOOK good.

STORAGE OF PARTS

After inspection and cleaning of all parts

store them in a CLEAN, DRY area until you begin your rebuild. Before commencing, try your best to get all the replacement parts you could conceivably need since there is nothing worse than having to quit halfway through the job and wait four weeks for a bearing or something. Keep all the bearings well oiled during storage. Ideally, cut the top off a quart of motor oil, pour half of it into another container, and store the bearings submerged in oil.

REASSEMBLY OF THE 5-SPEED GEARBOX

- 1) Install the 3rd speed gear roller bearing over the nose of the mainshaft and lubricate it with motor oil. Install the 3rd speed gear over the bearing with the synchronizer side FORWARD. Install the coupling sleeve hub (with sleeve installed) onto the splines with the wide lower shoulder on the hub to the rear. The shoulder difference is discernable near the splined opening for the shaft. There is a thrust surface on both sides of the hub that tapers up to the support for the sleeve. One thrust surface is offset to one side. This is the wide shoulder. Tap the hub onto the splines until it seats. Match fit a snap ring to the slot in front of the hub to minimize end-play. Too thin a snap ring will allow the hub to move on the shaft and cause gear engagement problems. Too thick a snap ring will not seat properly and could come loose.
- 2) Install the 2nd speed gear bearing from the rear of the mainshaft and lubricate it with motor oil. Install the 2nd speed gear over the bearing with the synchronizer side facing REARWARD. Install the coupling sleeve hub (with the sleeve installed) over the splines with the wide shoulder facing the 2nd speed gear. Install the 1st speed bearing bushing, bearing (oiled), and the 1st speed gear with the synchronizer side FORWARD.
- 3) Install the steel ball bearing in the hole and the thrust washer over it. The ball must be centered under the thrust washer. Be sure that the 1st speed gear bearing sleeve is all the way forward against the 1st/2nd coupling sleeve hub.
- 4) Press the main drive ball bearing onto the shaft with the snap ring groove facing REARWARD. Be absolutely certain that the thrust washer and ball do not become dislodged during this operation. When all is assembled, there should be only a few THOUSANDTHS end-play in the gear stack in front of this bearing.
- 5) Press the front and center ball bearings onto both ends of the countershaft being sure that they seat tightly against the shoulders on the shaft.
- 6) Place the assembly plate in a vise or other holder being careful not to damage the gasket sealing surfaces.
- 7) Install the main drive bearing onto the input shaft with the snap ring groove FORWARD. Measure the gap between the bearing face and the REAR of the snap ring groove on the shaft. Select and install a shim that is AT LEAST THAT THICK. Measure the gap from the front surface of the shim to the front edge of the snap ring groove on the input shaft. Select a snap ring that most closely equals that dimension without going over. Ideally, you should juggle shims and snap rings until there is NO gap that is left. The goal is to prevent the bearing from moving on the shaft under loading conditions. Install the roller bearing into the recess at the rear of the input shaft. Oil it well.
- 8) Put the input shaft onto the nose of the mainshaft. Be sure you have the coupling sleeve installed as well as the input shaft bearing. Hold the countershaft beside the mainshaft and mesh the four gearsets. Pass the rear of both shafts through the openings in the assembly plate simultaneously, keeping the gears meshed. A little oil in the bearing holes helps the bearings to slide in. Carefully tap the two shafts into the plate using a soft hammer (brass or lead). Tap the mainshaft rearward until the snap ring groove in the main drive bearing is completely exposed. Install the snap ring. Tap the mainshaft forward until the snap ring seats in its groove in the assembly plate. Install the countershaft bearing spacer ring, install the bearing retainer plate, and tighten the six phillips head screws to 10 ft. lb. Using a centerpunch, dimple the edge of each screw where it meets the bearing retainer plate to secure them from loosening. TWO DIMPLES PER SCREW. Tap the countershaft rearward toward the bearing retainer to be sure it is firmly seated against the spacer and retainer plate.
- 9) Line up the hole in the side of the reverse idler shaft and tap it in the hole in the assembly plate. Be very careful to accurately line up the shaft. Hold with the hole for the set pin. Install the set pin and tighten. Install the special flatwasher, lockwasher and

- nut on the shaft, tightening the nut to 53 ft. lb. Use a center punch topeen two dimples in the joint between the nut and shaft to aid in locking the nut onto the shaft. Install the reverse idler roller bearing, reverse idler gear, thrust washer, and HEAVY snap ring. The gear should have the rounded edges of the teeth to the rear. Be very careful with this snap ring since it can really fly when it comes loose. SAFETY GOGGLES WOULD BE A GOOD IDEA FOR THIS OPERATION.
- 10) Install the reverse main gear hub on the mainshaft splines with the long side of the hub facing forward. Install the reverse main gear onto the hub with the shifting fork groove facing rearward. Slide the 5th speed gear bearing bushing onto the mainshaft to hold the hub in place.
 - 11) Slide the reverse counter gear onto the splines of the countershaft with the long shoulder facing rearward. The reverse counter gear should now mesh nicely with the reverse idler gear.
 - 12) Install the two 5th speed gear roller bearings onto the bearing sleeve and oil lightly. Install 5th speed gear with the synchronizer side facing forward. Install the steel ball bearing in the hole in the mainshaft and cover with the thrust washer. Install a NEW locking plate making sure that the two tabs engage the slots in the thrust washer. EVEN IN GEARBOXES USING THE DOUBLE NUTS, INSTALL A LOCKING PLATE FOR EXTRA SAFETY. Install a mainshaft nut, finger tight, to hold the assembly in place.
 - 13) Install the countershaft overdrive gear onto the splines of the countershaft. Install the bearing onto the tip of the countershaft. Install the washer, lock-washer, and nut. Tighten to 40 ft. lb.
 - 14) Work the coupling sleeves by hand and engage two gears simultaneously. This will lock the entire geartrain and enable you to tighten the rear retaining nut(s). Tighten the nut to 140 ft. lb. Lock at least three of the lock plate ears onto the flats of the nut. If two nuts are used, tighten the first to 20 ft. lb. and tighten the second against the first at 15 ft. lb. Hold the second nut and tighten the first nut against the second nut at 215 ft. lb. Lock the lock plate ears. Disengage the coupling sleeves to return the gearbox to neutral.
 - 15) Moving rearward on the mainshaft, install the snap ring, ball bearing, snap ring, snap ring, steel ball, speedometer drive gear, snap ring, and snap ring. Take particular note that the first four snap rings are 'calibrated', that is to say you must fit them so that the gap between the rings and the retained parts is absolutely minimal to prevent movement of the parts. These snap rings come in about six different sizes and you need to pick them according to their thickness to minimize slop in the finished assemblies.
 - 16) Install the 5th/reverse shifting fork into the groove in the reverse main gear with the long end facing the assembly plate. Slide the 5th/reverse shifting rod through the fork and assembly plate with the striker rod end facing AWAY from the countershaft. Match the holes in the fork and rod and drive in a retaining pin to secure the fork to the shifting rod.
 - 17) Install the two steel interlock balls in the hole in the assembly plate that runs between the 5th/reverse rod hole and the 3rd/4th rod hole. If you coat them with a little grease they tend to stay put better. Install the 3rd/4th shifting fork on the 3rd/4th coupling sleeve with the long end facing forward. Slide the 3rd/4th shifting rod through the assembly plate center hole and onto the fork. Push it forward until the striking rod end lines up with the 5th/reverse shifting rod just installed. Make sure that the retaining pin hole in the fork lines up with the hole in the shifting rod. Install the retaining pin.
 - 18) Insert the two interlock balls into the hole in the assembly plate between the 3rd/4th shifting rod hole and the 1st/2nd shifting rod hole. Again, a little grease will help hold the balls in place. Install the 1st/2nd shifting fork on the coupling sleeve with the long side facing rearward. Slide the 1st/2nd shifting rod through the assembly plate and through the fork. When you are through the shifting rods should form a little square pocket at the rear end for the tip of the striking rod to fit in. Line up the hole in the fork with the hole in the rod and insert the retaining pin. On Warner type gearboxes there are large circlips on the shifting rods just in front of the assembly plate. Install them now.

- 19) Drop one check ball into each of the three holes in the edge of the assembly plate. Install one check ball spring in each hold on top of the balls. Apply a little bit of gasket sealant onto the check ball plugs and install the plugs with the SHORTEST plug in the MIDDLE HOLE. Tighten the plugs to 20 ft. lb. Check the operation of the shifter by working the shift linkages by hand. They should move stiffly without jamming. Clear up any problems with the linkage before proceeding.
- 20) Lay a new gasket on the front side of the assembly plate being sure that all the holes line up properly. Slide the center gearbox casing over the front of the input and countershafts. A little oil on the outer surface of the ball bearings will aid them sliding into the holes in the casing. Tap the casing down gently. You do not want to force the input shaft. On Warner type units, you can easily jam the 4th speed synchronizer making it appear that the gearbox is jammed in gear. Tap the casing on until it seats against the assembly plate. If the input shaft is too far back in the casing to install the snap ring in the main drive bearing you must pull it forward. Check to see that the gearbox has 'neutral' by holding the output shaft and turning the input shaft. Of course it must be in neutral to check this. This is to see if you have jammed anything during this step. Install the snap ring on the outside of the input shaft main drive ball bearing. After installing the snap ring, tap the bearing rearward until the snap ring rests on the front of the casing. Tap the countershaft rearward to be sure it seats against the assembly plate bearing retainer plate.
- 21) Measure the depth from the surface of the casing to the face of the countershaft ball bearing. A ruler won't do the job, you'll need to use a vernier caliper or depth gauge or something that will measure to .001". Select a shim (or shims) that most closely approximate this dimension WITHOUT EXCEEDING IT. TOO THICK OF A SHIM WILL PRELOAD THE BEARING CAUSING IT TO QUICKLY SELF-DESTRUCT. If you must err, err slightly to the too thin side. Now measure the height of the top surface of the input shaft main drive bearing from the face of the casing. This becomes dimension 'B'. Take the bell-housing and measure the depth to the rear surface of the throwout bearing support tube after a new o-ring has been installed and seated. This becomes dimension 'A'. The main drive bearing shims come in thicknesses of .0472", .0551", and .0630". These are dimension 'C'. Manipulate dimension 'C' so that $A - B - C$ equals approximately .0079". Install this shim on the bearing face between it and the throwout bearing support tube.
- 22) Install a new shaft seal into the back of the throwout bearing support tube with the flat side facing FORWARD. Wipe a light film of oil onto the inner surface of the seal to ease assembly over the shaft. Lay a new gasket on the front surface of the center casing. Slide the bell-housing over the input shaft making sure that the shims and gasket do not get dislodged. Try to keep the housing centered on the shaft to prevent damage to the seal. Install the ten bolts and lockwashers. Tighten evenly to 16 ft. lb.
- 23) Install a new throwout bearing onto the cast iron release sleeve. Grease the inside of the release sleeve where it will ride on the support tube. Install the bearing sleeve onto the throwout arm. Grease the socket where the throwout arm pivots on the ball. Slide the sleeve over the support tube while at the same time threading the throwout arm out the hole in the side of the bell-housing. Locate the arm onto the ball and press it into place until the retaining spring locks. Install a new dust shield in the bell-housing hole.
- 24) Install a new gasket on the rear side of the assembly plate making sure that all holes line up. Place the tip of the striker rod in the pocket formed by the shifting rods. Carefully guide the tailshaft housing onto the rear of the mainshaft being sure that the striking rod and mainshaft fall into their respective holes. Tap the tailshaft housing into place gently making sure that the striking rod does not dislodge the o-ring and cap when it pops out the rear of the housing. Install the eight bolts and lockwashers and tighten them to 16 ft. lb.
- 25) Install the bearing shim and rear bearing onto the mainshaft. Install a new rear main seal by first oiling its outer edge and then pressing into the housing with the flat side REARWARD. Install the driveshaft flange by tapping it down onto the splines against the

bearing. Install the washer and nut. Grip the flange tightly across the flats in a vise or with LARGE channel locks and tighten the nut to 100 - 120 ft. lb. You are given a range so you can line up the holes in the shaft with the slots in the castle nut. If you use a plain locking nut, torque it to 120 ft. lb.

- 26) Install a new rubber engine mounting using new lockwashers.
- 27) Install the gear lever control arm pin and circlip to lock the control arm to the striking rod.
- 28) Fill the gearbox with 87 ounces (2.7 quarts) of SAE 80W-90 or SAE 90W EP gear lubricant. Rotate the input and output shafts to coat the gears with oil.
- 29) Install two new rubber bushings into the top of the control arm and secure with a piece of wire so they don't fall out and get lost.
- 30) Install a gear lever and carefully test all gears for proper engagement and operation. It will help to rotate the shafts a bit to smooth the meshing of the coupling sleeve teeth with the gears. The shifting should be stiff, but not impossible.
- 31) Install a new vent breather into the top of the tailshaft housing by tapping lightly with a hammer. Make sure the little arrow on top points front.

The gearbox is now ready for installation onto the engine. Do not turn it upside down or sideways or the oil will leak out the breather.

Make sure that the drain plug and filler plug are both tight before installing the gearbox into the car.