

Chapter 7 Part A Manual transmission

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Specifications

FS5W71C 5 speed manual transmission

Gear ratios	
1st	3.321:1
2nd	1.902:1
3rd	1.308:1
4th	1.000:1
overdrive	0.759:1
reverse	3.382:1
Oil capacity	See Chapter 1
Gear backlash	
main drive gear	0.0020 to 0.0039 in
1st gear	0.0020 to 0.0079 in
2nd gear	0.0020 to 0.0079 in
3rd gear	0.0020 to 0.0079 in
overdrive	0.0020 to 0.0079 in
reverse idler gear	0.0020 to 0.0079 in
Gear end play	
1st gear	
1986	0.0122 to 0.0161 in
1984-1985	0.0122 to 0.0146 in
2nd gear	
1986	0.0043 to 0.0083 in
1984-1985	0.0043 to 0.0067 in
3rd gear	
1986	0.0043 to 0.0083 in
1984-1985	0.0043 to 0.0067 in
overdrive gear	
1986	0.0126 to 0.0197 in
1984-1985	0.0126 to 0.0138 in
reverse idler gear	
all	0.0020 to 0.0197 in
Baulk ring to gear clearance	
1st and 2nd gears	
1986	0.0394 to 0.0630 in
1984-1985	0.0394 to 0.0551 in
3rd and main drive gears	
1986	0.0472 to 0.0630 in
1984-1985	0.0472 to 0.0591 in
overdrive gear	
all	0.0394 to 0.0551 in

Wear limit	
1st and 2nd gears	
1986	0.031 in
1984-1985	0.020 in
3rd and main drive gears	0.031 in
overdrive gear	0.020 in
Available snap rings	
main drive gear bearing	0.0681 in
	0.0709 in
	0.0736 in
	0.0764 in
	0.0791 in
	0.0819 in
mainshaft front	0.094 in
	0.098 in
	0.102 in
mainshaft rear end bearing	0.043 in
	0.047 in
	0.051 in
	0.055 in
counter drive gear	0.055 in
	0.059 in
	0.063 in
Available shims for countershaft front bearing	
Distance from bearing surface to transmission case	
1986	
0.1780 to 0.1854 in	not necessary
0.1740 to 0.1776 in	0.004 in
0.1701 to 0.1736 in	0.008 in
0.1661 to 0.1697 in	0.012 in
0.1622 to 0.1657 in	0.016 in
0.1583 to 0.1618 in	0.020 in
0.1543 to 0.1579 in	0.024 in
1984-1985	
0.1346 to 0.1382 in	0.004 in
0.1307 to 0.1343 in	0.008 in
0.1268 to 0.1303 in	0.012 in
0.1228 to 0.1264 in	0.016 in
0.1189 to 0.1224 in	0.020 in
0.1150 to 0.1185 in	0.024 in

Model BW T-5 (FS5R90A) 5 speed manual transmission

Gear backlash	
main drive gear	0.0020 to 0.0059 in
1st gear	0.0020 to 0.0059 in
2nd gear	0.0020 to 0.0059 in
3rd gear	0.0020 to 0.0059 in
overdrive gear	0.0020 to 0.0059 in
reverse idler gear	0.0020 to 0.0079 in
Gear end play	
1st gear	0.0039 to 0.0098 in
2nd gear	0.0039 to 0.0098 in
3rd gear	0.0059 to 0.0157 in
5th counter gear	0.0039 to 0.0189 in
counter gear	0.0098 to 0.0197 in
Preload of main drive gear bearing	0.0051 to 0.0098 in
Main drive gear bearing adjusting shims	0.0122 in
	0.0142 in
	0.0161 in
	0.0181 in
	0.0201 in
	0.0220 in
	0.0362 in
	0.0441 in

Torque specifications

	Ft-lbs
Clutch operating cylinder	22 to 30
Transmission to engine	29 to 36
Engine gusset to transmission	22 to 29
Crossmember to body	23 to 31
Rear mounting insulator to rear extension	23 to 31
Starter motor to transmission	22 to 39

Torque specifications (continued)

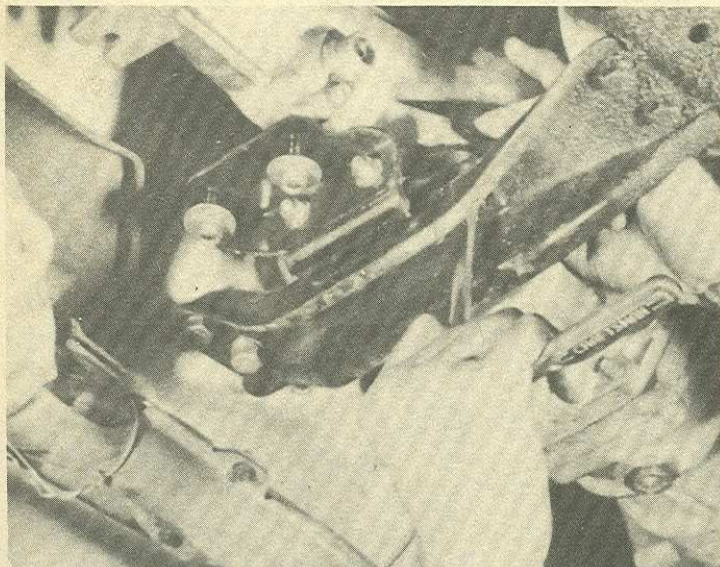
	Ft-lbs
Model FS5W71C transmission gear assembly	
rear extension to transmission case	12 to 14
front cover to transmission case	12 to 15
control housing to rear extension	10 to 13
ball pin	14 to 25
filler plug	18 to 25
drain plug	18 to 25
speedometer sleeve installation	2.9 to 3.6
return spring plug	
1985-1986	14 to 22
1984	5.8 to 7.2
reverse check sleeve to transmission case	2.9 to 3.6
reverse lamp switch	14 to 22
check ball plug	14 to 18
mainshaft lock nut	101 to 123
countershaft lock nut	72 to 94
striking lever lock nut	6.5 to 8.7
bearing retainer to adapter plate	14 to 18
Model BW T-5 FS5R90A transmission gear assembly	
clutch housing to case	30 to 51
cover to case	6.0 to 10.8
front retainer to case	11 to 20
filler plug	14 to 25
drain plug	14 to 25
speedometer sleeve	2.9 to 3.6
reverse pivot pin	15 to 25
neutral switch	14 to 22
extension to case	20 to 46
control lever housing to extension	11 to 20

1 General information

The manual transmissions installed in the ZX models are conventional five-speeds. The non-turbo models are equipped with either an FS5W71C (all years) or an FS5R30A (1987 on) transmission. The turbo models are equipped with a BW T-5 FS5R90A type. All transmissions have synchromesh on all forward gears. **Note:** *Overhaul procedures and specifications for the model FS5R30A could not be included at the time this manual was published.*

The main driveshaft gear is meshed with the counter drive gear. The forward speed gears on the countershaft are in constant mesh with the main gears.

When the shift lever is operated, the relevant coupling sleeve is caused to slide on the synchronizer hub and engages its inner teeth with the outer teeth on the mainshaft gear. Moving the shift lever to the Reverse gear position moves the mainshaft reverse gear into engagement with the reverse idler gear.



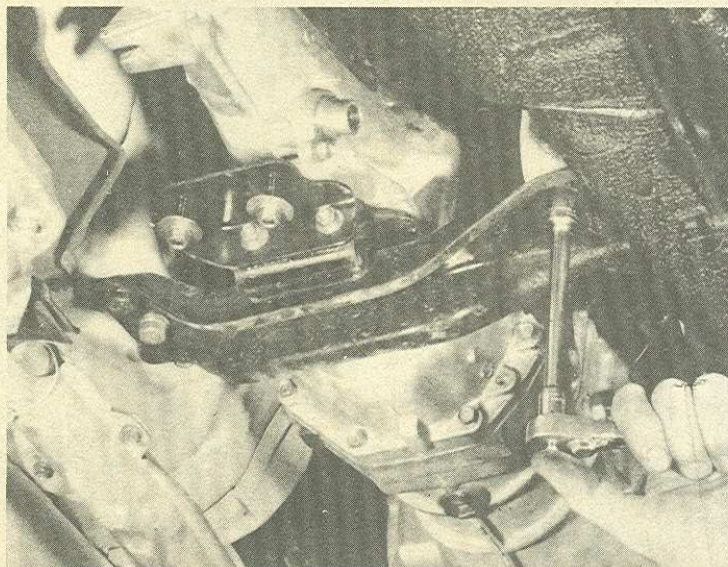
2.8 Remove the two through bolts securing the mount to the crossmember

2 Transmission mount – check and replacement

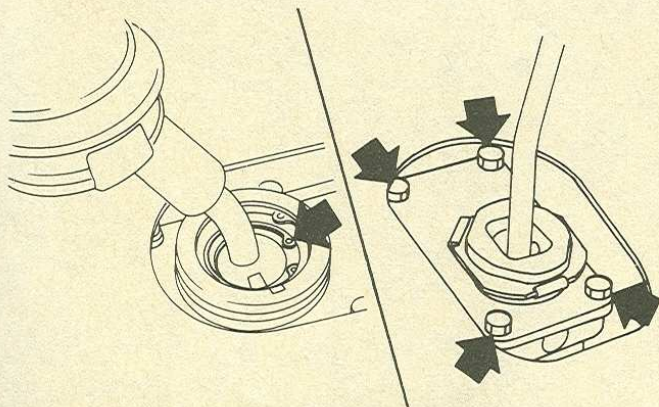
Refer to illustration 2.8 and 2.9

Check

- 1 Raise the vehicle and support it securely on jackstands. Make sure the vehicle is stable as it will be necessary to jostle it during the course of checking and replacing the mounts.
- 2 Push up on the transmission extension housing and note the amount the housing moves.
- 3 Pull down on the extension housing and note the amount of movement available.
- 4 If the extension housing can be pushed upwards a greater distance than it can be pulled down, it is an indication that the rubber is worn and the mount has bottomed out.
- 5 If the rubber portion of the mount separates from the metal plate when you push upwards, the mount should be replaced.



2.9 Remove the four bolts securing the crossmember to the body and remove the crossmember



3.4 Remove the FS5W71C shifter by removing the snap ring (left) and remove the FS5R90A shifter by removing the four retaining bolts (right)

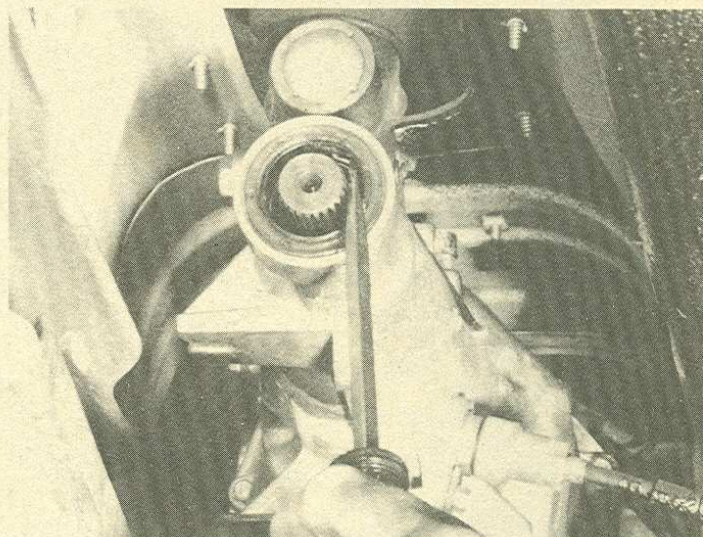
Replacement

- 6 Remove the front exhaust tube (Chapter 4). **Note:** Wire the catalytic converter to the body.
- 7 Use a jack positioned under the transmission to support the weight of the transmission. **Caution:** Place a block of wood between the jack and the transmission to protect the transmission case.
- 8 Remove the two through bolts securing the mount to the crossmember (see illustration).
- 9 Remove the four retaining bolts securing the crossmember to the body and remove the crossmember (see illustration).
- 10 Remove the two bolts retaining the mount to the transmission and remove the mount.
- 11 Reverse the removal procedure for installation.

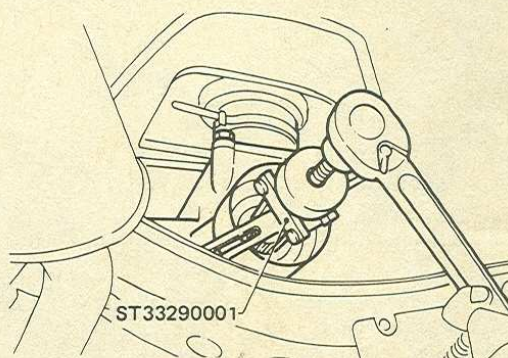
3 Transmission — removal and installation

Refer to illustration 3.4

- 1 Disconnect the negative cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery.
- 2 Raise the vehicle and support it at the four corners with jackstands. Be sure to raise the vehicle enough so the transmission can be slid from underneath when removed.
- 3 From inside the vehicle remove the console. Refer to Chapter 11 if necessary.
- 4 If equipped with a FS5W71C transmission (non-turbo), remove the shift lever by removing the large snap-ring retaining the shifter ball to the transmission. On FS5R90A models, remove the shifter by removing the four retaining bolts and lift off the shifter (see illustration).
- 5 From underneath the vehicle, remove the exhaust front tube, catalytic converter and crossover connecting pipe.
- 6 Disconnect the six retaining bolts and remove the catalytic converter heat shield.
- 7 Disconnect the wires from the back-up light switch, the top gear switch, the neutral switch and/or the overdrive switch as equipped, at the transmission. Mark the connectors with tape or paint for identification.
- 8 Disconnect the speedometer cable at the transmission (Section 5).
- 9 Drain the oil from the transmission.
- 10 Remove the driveshaft as described in Chapter 8.
- 11 Remove the exhaust pipe support bracket.
- 12 Unbolt and remove the clutch operating cylinder and tie it back out of the way.
- 13 Support the engine under the oil pan, using a jack and a block of wood as an insulator. **Caution:** Do not support engine at the drain plug.
- 14 Place a jack under the transmission.
- 15 Remove the transmission mounting insulator nuts and the mounting-to-frame bolts (Section 2).
- 16 Remove the starter motor from the bellhousing (Chapter 5).
- 17 Remove the bolts which secure the bellhousing to the engine. These



4.6a Removing the transmission rear extension seal with a screwdriver



4.6b Nissan offers special tool ST33290001 for pulling the rear extension seal

bolts are of unequal length and should be laid out in order so they can be returned to their original locations.

18 Lower each of the two jacks simultaneously, until the transmission can be withdrawn to the rear and removed from beneath the vehicle. **Caution:** Do not allow the weight of the transmission to hang on the input shaft while it is still engaged with the clutch plate splines.

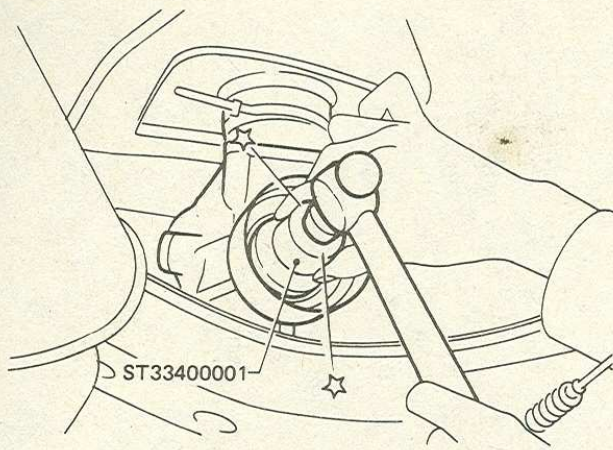
19 Installation is the reverse of the removal. Smear a small amount of grease on the input shaft splines and check clutch mechanism alignment as described in Chapter 8.

20 Check the clutch pedal free travel and adjust if necessary (Chapter 8). Remember to fill the transmission with the correct grade and quantity of lubricant.

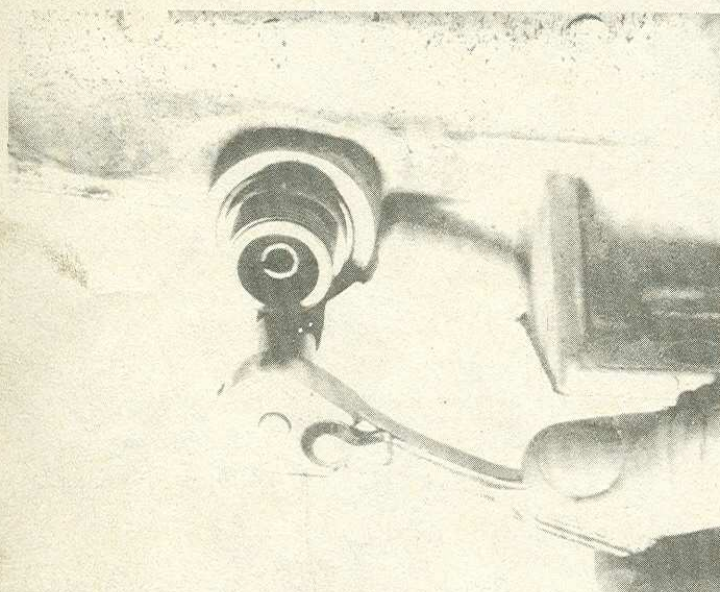
4 Extension housing oil seal — replacement

Refer to illustration 4.6a, 4.6b and 4.7

- 1 Disconnect the negative cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery.
- 2 Raise the vehicle and support it at four corners with jackstands.
- 3 From underneath the vehicle, remove the exhaust front tube and catalytic converter (Chapter 4).
- 4 Disconnect the retaining bolts and remove the catalytic converter heat shield.
- 5 Remove the driveshaft (Chapter 8).
- 6 Use a long screwdriver to pry out the old seal (see illustration). Be careful not to damage the output shaft of the transmission housing. An alternative method of removal is to sink a sheet metal screw into the metal face of the seal and use the screw (or screws) to work the seal out of its recess. Nissan tool ST33290001 is used by factory mechanics to pull the seal from the transmission (see illustration).



4.7 Carefully drive the seal into its recess using either the special tool shown or use a socket or piece of pipe



5.4 Remove the speedometer lock plate hold-down bolt

7 Apply a coat of gear oil to the lips of the new seal and apply sealant to the outside diameter of the seal, then carefully drive it into place using a socket or piece of pipe. Special tools are available from Nissan for this procedure. Nissan tool ST33400001 is used to drive the seal into position (see illustration).

8 The remainder of the installation is the reverse of the removal procedures.

5 Speedometer pinion gear and seal — replacement

Refer to illustrations 5.3, 5.4 and 5.5

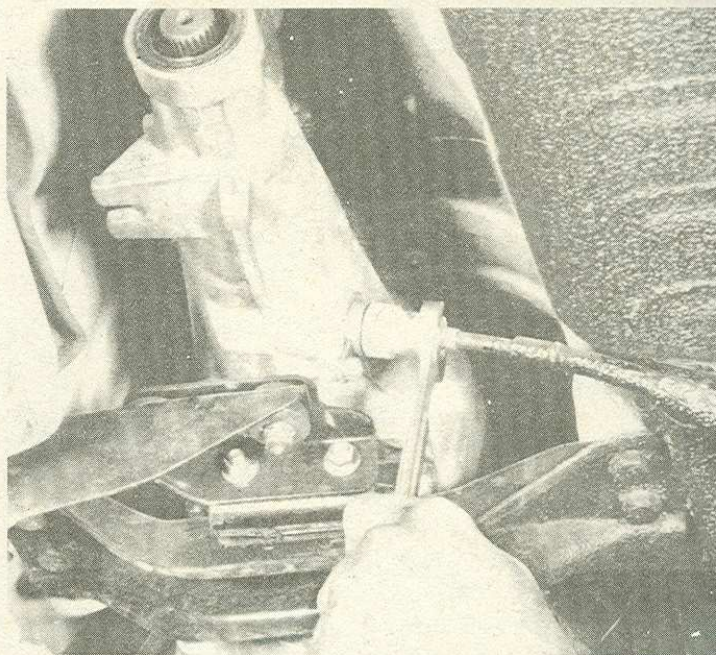
1 The speedometer pinion gear and seal can be removed without removing the transmission from the vehicle. **Warning:** Exhaust components are extremely hot after the engine has been running, allow the exhaust system cool completely before starting this project.

2 Raise the vehicle and support it securely on jackstands.

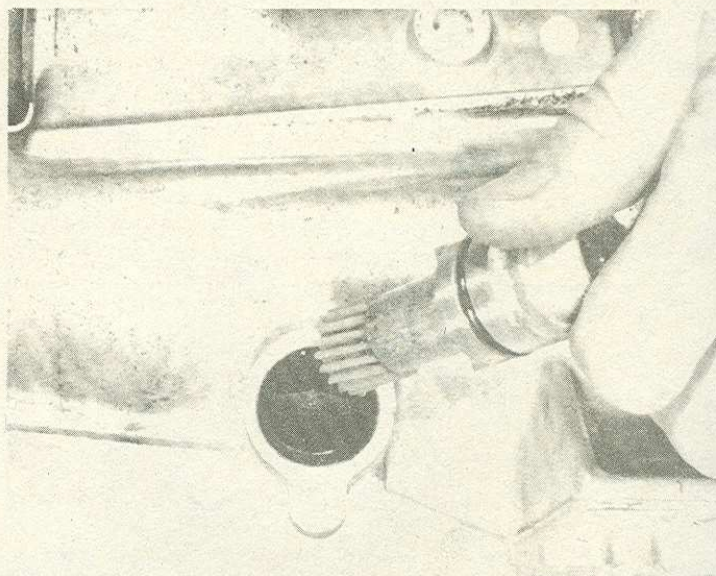
3 Unscrew the speedometer cable from the transmission (see illustration).

4 Disconnect the speedometer lock plate hold-down bolt and remove the lock plate (see illustration). **Note:** If equipped, make note of the ground wire connected to the hold-down bolt and be sure to install it on installation.

5 It may be necessary to gently pry the gear from the extension hous-



5.3 Unscrew the speedometer cable from the transmission



5.5 Remove the speedometer pinion gear from the transmission

ing with a screwdriver. Remove the pinion gear (see illustration).

6 Pry off the O-ring and replace with a new one.

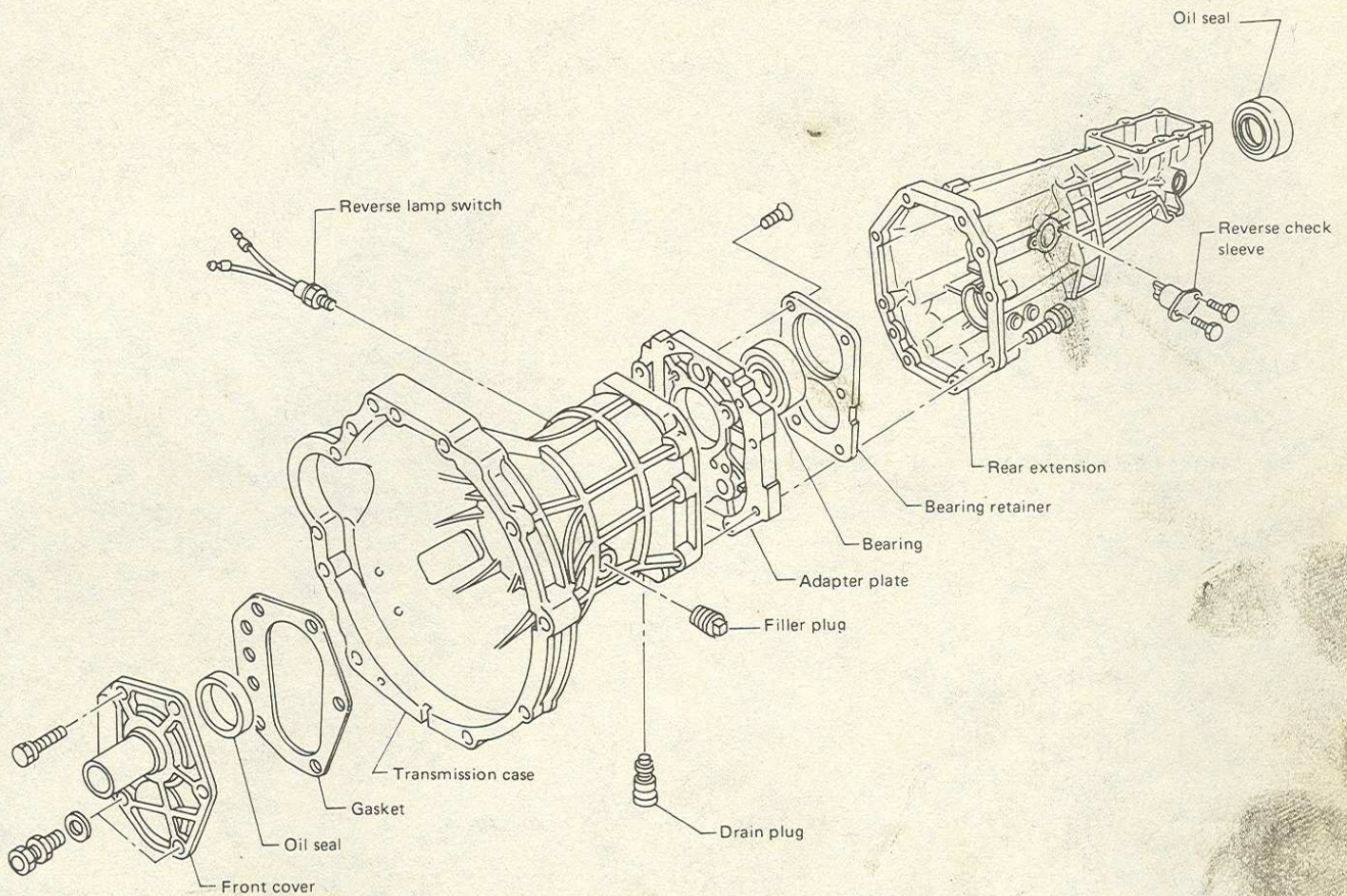
7 Installation is the reverse of the removal, but lubricate the new seal with transmission lubricant and hold the assembly so that the slot in the fitting is toward the lock plate boss on the extension.

6 5-speed transmission (FS5W71C) — overhaul

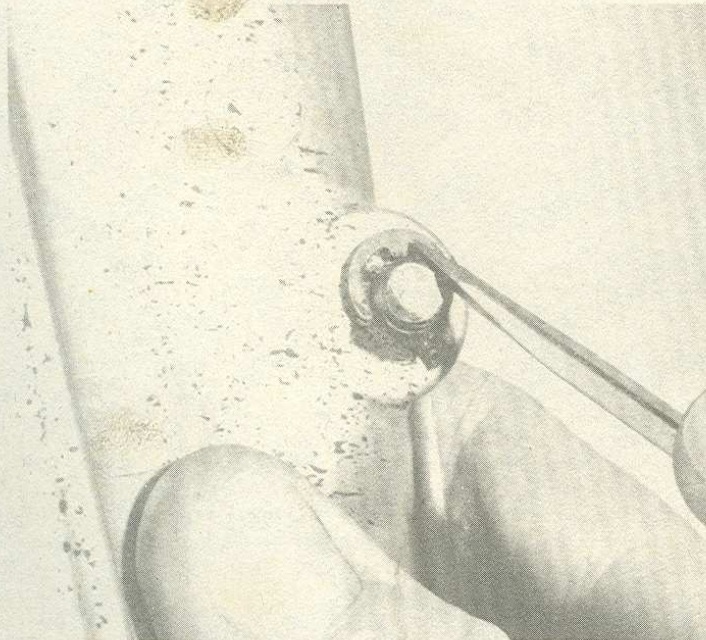
Refer to illustrations 6.4, 6.6a, 6.6b, 6.7, 6.8, 6.9, 6.10, 6.12, 6.16, 6.18, 6.20, 6.22a, 6.22b, 6.34, 6.38, 6.64a, 6.64b, 6.72a, 6.72b, 6.73, 6.75, 6.76, 6.84a, 6.84b, 6.94, 6.96, 6.97 and 6.105

Initial disassembly

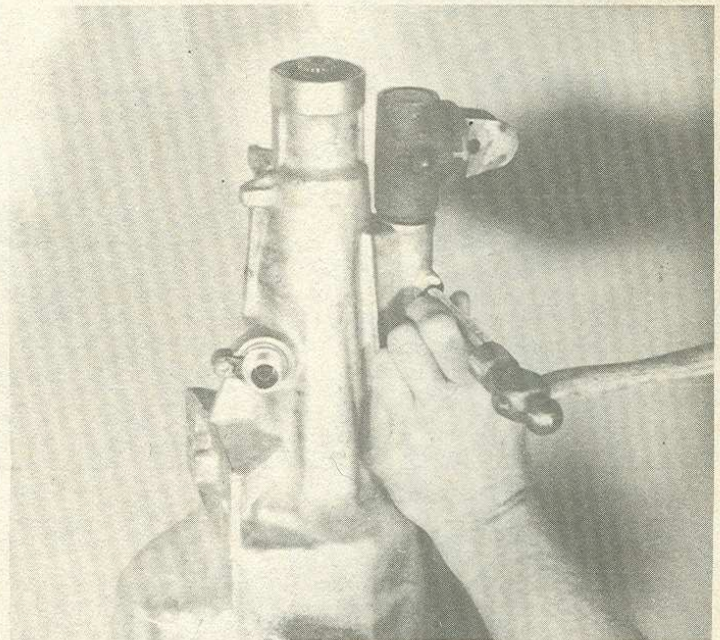
1 With the transmission removed, thoroughly clean the external surfaces.



6.4 Case components of the FS5W71C 5-speed manual transmission



6.6a Pry off the E-ring from the stopper guide pin

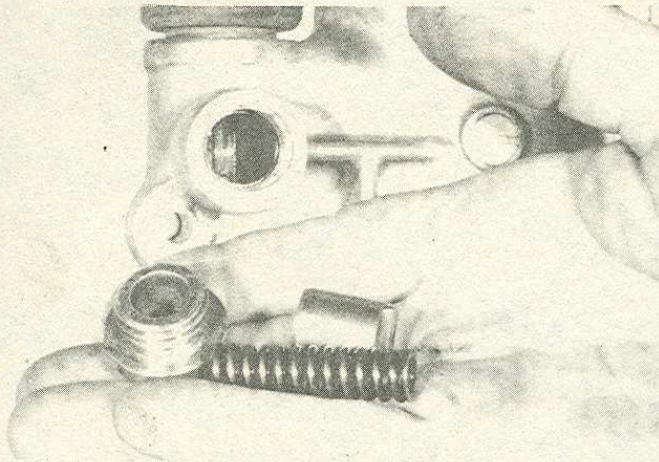


6.6b Use a small punch to drive out the stopper guide pin

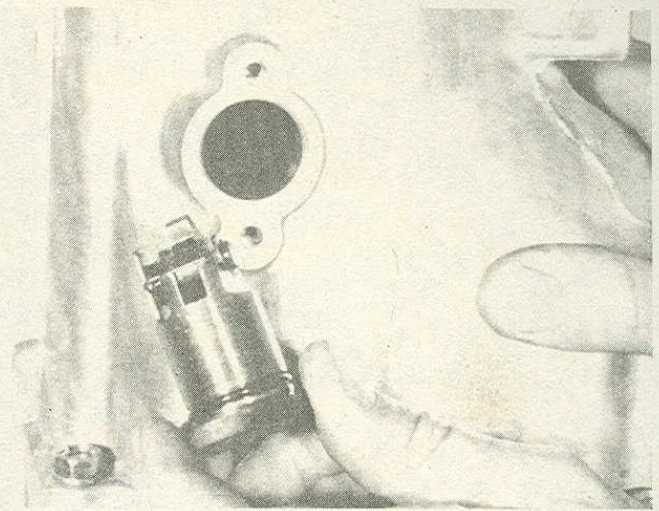
7A

- 2 Remove the rubber dust boot from the withdrawal lever opening in the clutch bellhousing.
- 3 Remove the release bearing and hub, together with the withdrawal lever (Chapter 8).
- 4 Remove the reverse lamp switch, neutral switch, top gear switch,

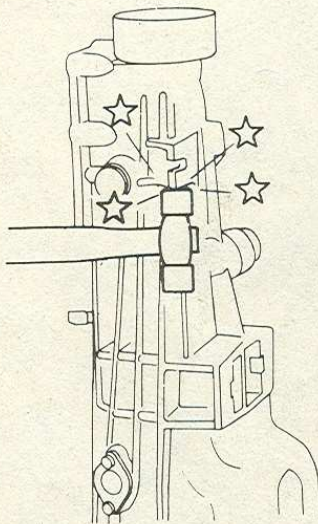
- and/or overdrive gear switch, as equipped (see illustration).
- 5 Remove the screw retaining the speedometer gear to the rear extension housing and lift out the gear (Section 3).
- 6 Pry off the E-ring from the stopper guide pin (see illustration) and drive out the pin (see illustration).



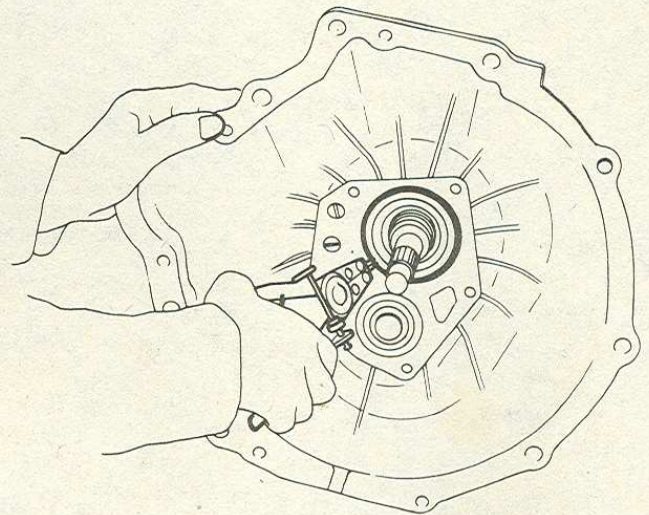
6.7 Remove the plug and lift out the return spring and plunger



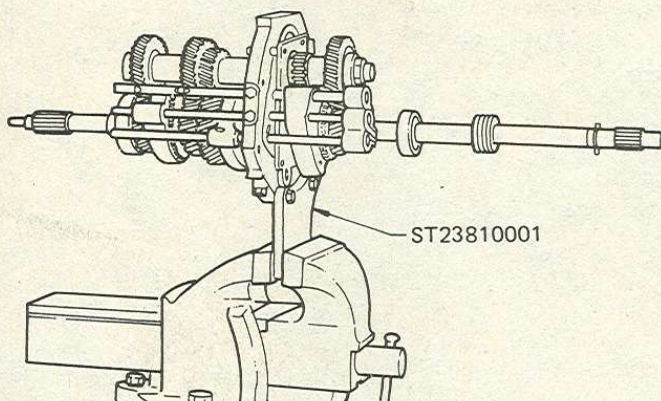
6.8 Remove the cover and the reverse check sleeve



6.9 Remove the bolts and use a soft face hammer to drive the rear extension housing from the main casing



6.10 Extract the countershaft bearing shim and input shaft bearing snap ring



6.12 A suitable plate can be fabricated to support the adapter and gear assembly while working on it or you can purchase one from Nissan

7 Remove the return spring plug and lift out the return spring and plunger (see illustration).

8 Remove the two screws retaining the reverse check cover to the housing and lift out the reverse check sleeve (see illustration).

9 Remove the bolts and drive the rear extension housing from the main transmission casing, using a soft mallet (see illustration).

10 Remove the front cover retaining bolts. Remove the front cover with gasket and extract the countershaft bearing shim and the input shaft bearing snap-ring (see illustration).

11 Drive off the one-piece bellhousing/transmission casing from the adapter plate, using a soft face hammer and holding the exposed rear shaft.

12 Make up a suitable plate and bolt it to the transmission adapter, or purchase tool ST23810001 from Nissan, and support the adapter in a vise (see illustration).

13 Drive out the securing pins from each of the shift forks, using a suitable thin drift.

14 Remove the three check ball plugs.

15 Withdraw the selector rods from the adapter plate.

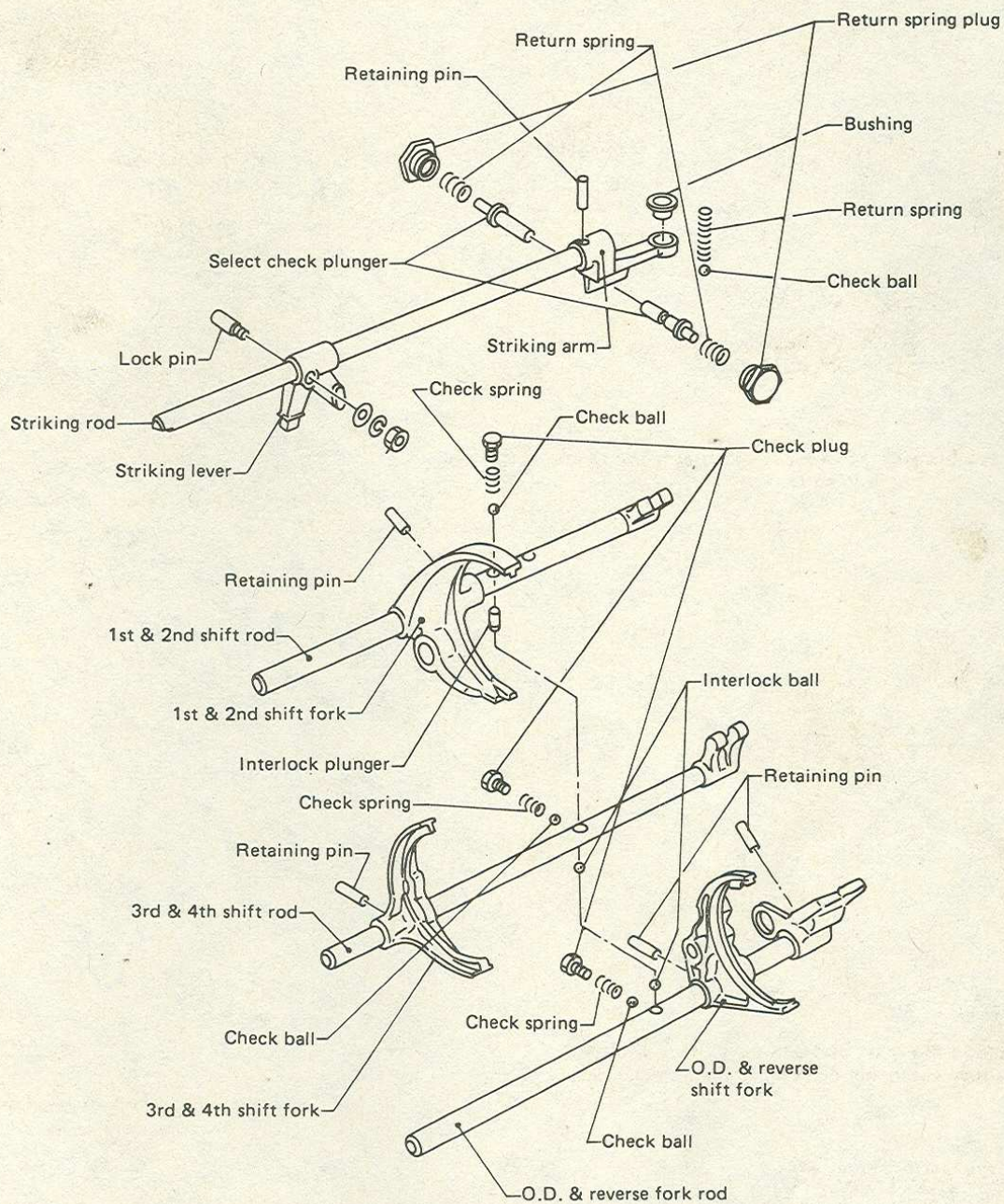
16 Catch the shift forks and extract the balls and springs as the selector rods are withdrawn. The four smaller balls are the interlock balls, (see illustration).

17 Inspect the gears and shafts for any wear, chipping or cracking.

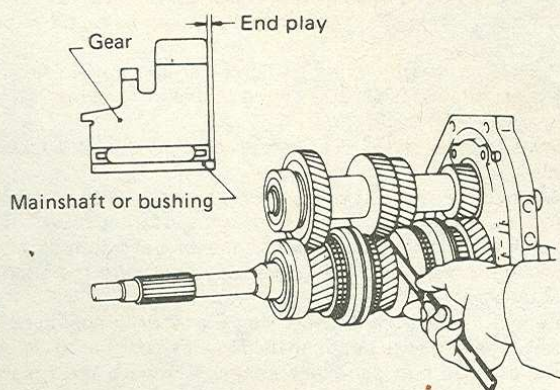
18 Use a feeler gauge between each mainshaft gear to determine the amount of gear end play that exists. Compare the results to the Specifications (see illustration).

19 If the gear end play is not within specifications, or if the gears or shafts show signs of wear or damage, the gear assemblies should be disassembled and the defective parts replaced.

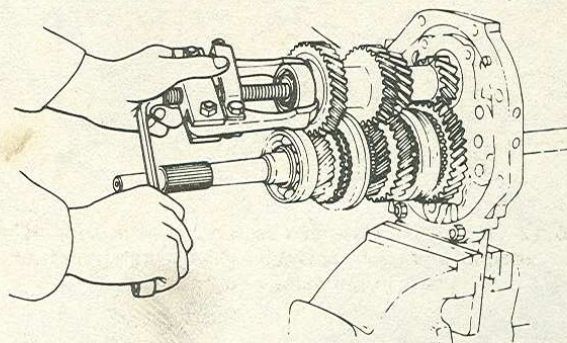
20 Lock the gears and, using a two leg puller, draw the front bearing from the countershaft (see illustration).



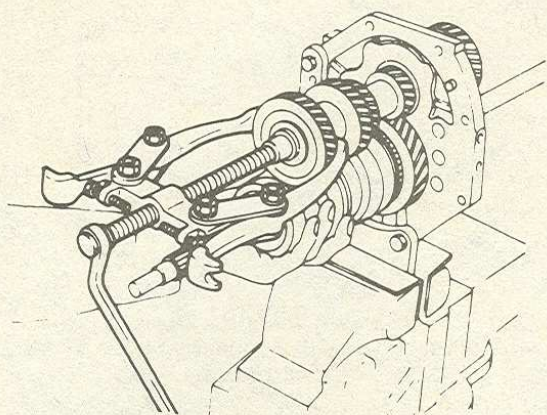
6.16 Shift forks — exploded view



6.18 Check gear end play with a feeler gauge and compare the results to the Specifications

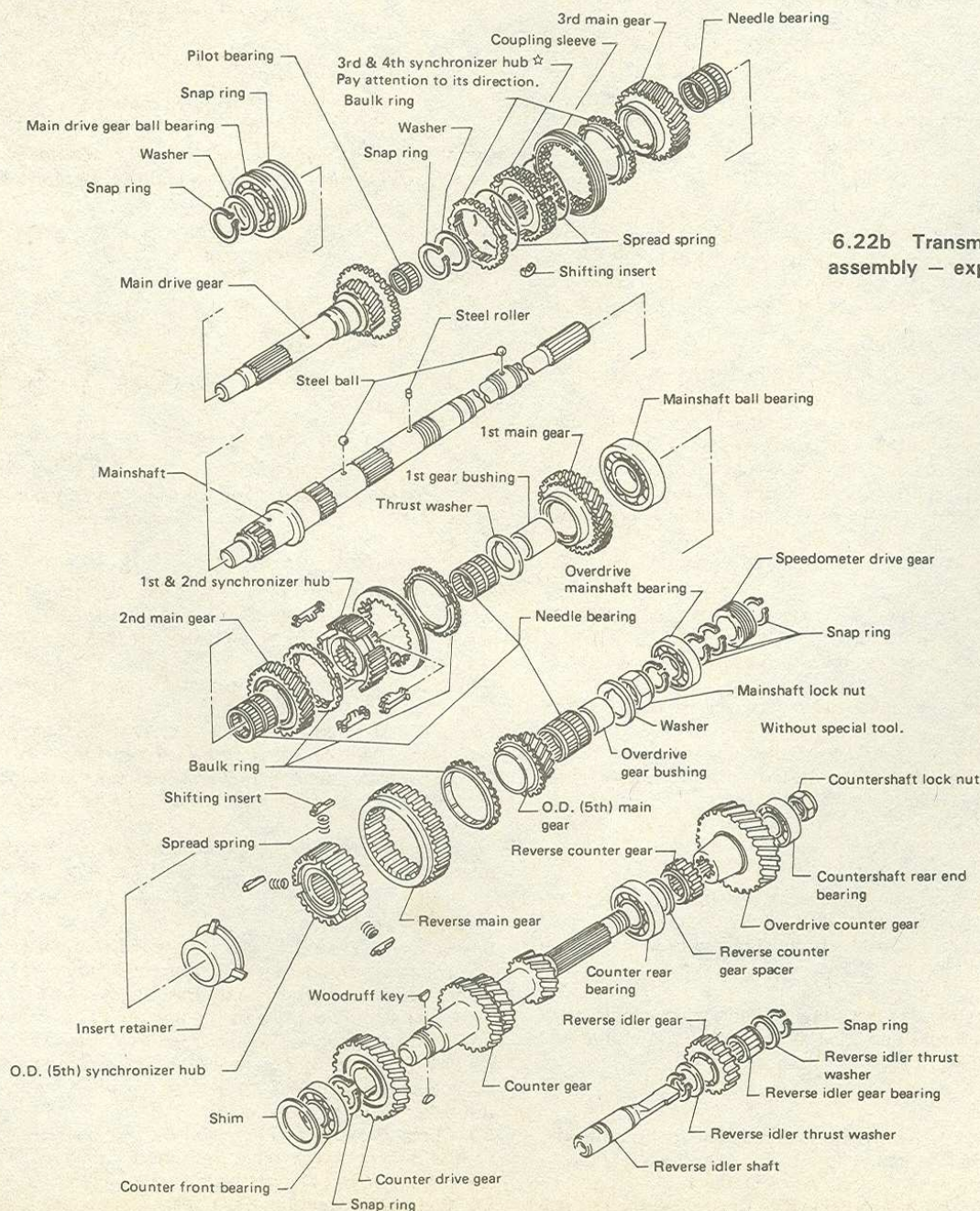


6.20 Use a puller to remove the countershaft front bearing

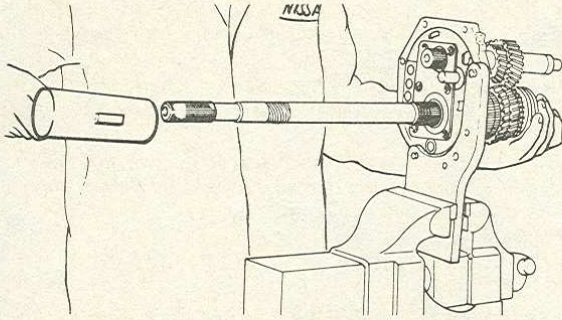


6.22a Extract the counter drive gear with the main drive gear assembly

- 21 Extract the now exposed snap-ring from the countershaft.
- 22 Withdraw the countershaft gear together with the input shaft (see illustration). Take care not to drop the needle roller bearing which is located on the front of the mainshaft (see illustration).
- 23 Extract the snap-ring from the front of the mainshaft, followed by the thrust washer.
- 24 Withdraw third and fourth synchronizer unit, followed by third gear.
- 25 Both the mainshaft nut and the countershaft nut are staked to prevent them from loosening. Use a hammer and punch to drive out the staking.
- 26 Remove the countershaft nut. Once removed, this nut should not be reused.
- 27 Use a gear puller to remove the countershaft overdrive gear and bearing.
- 28 Remove the reverse counter gear and spacer.
- 29 Remove the snap-ring from the reverse idler shaft and remove the reverse idler gear.
- 30 Remove the snap-ring retaining the speedometer gear to the mainshaft, then remove the speedometer gear and steel ball.
- 31 Remove the two snap-rings from behind the speedometer gear and withdraw the overdrive mainshaft bearing.



6.22b Transmission gear assembly — exploded view



6.34 Remove the mainshaft and countershaft as an assembly, using a rubber mallet to drive the assembly from the adapter

32 Drive out the staking on the mainshaft nut and remove it. Once removed, this nut should not be reused.

33 Remove the thrust washer, overdrive gear bushing, needle bearing, overdrive gear, reverse main gear, overdrive synchronizer assembly and insert retainer.

34 Drive the mainshaft and countershaft assemblies simultaneously from the adapter plate, using a soft-faced hammer (see illustration).

Mainshaft

35 Carefully examine the gears and shaft splines for chipping of the teeth or wear, then dismantle the gear train into its component parts, replacing any worn or damaged items.

36 Examine the shaft itself for scoring or grooving and the splines for twist, taper or general wear.

37 Examine the synchromesh units for cracks or wear and replace them if evident, particularly if there has been a history of noisy gear changes or where the synchromesh can be easily "beaten".

38 Press the baulk ring tight against the synchromesh cone and measure the gap between the two components. If it is less than specified, replace the components (see illustration).

39 When reassembling the synchromesh unit ensure that the ends of the snap-rings on opposite sides of the units do not engage in the same slot.

40 Begin assembly of the mainshaft by installing the second gear needle bearing, second gear, the baulk ring followed by the first/second synchromesh unit, noting carefully the direction of installing the latter.

41 Install the first gear baulk ring, needle bearing, steel ball, thrust washer, bushing and first gear. Be sure the steel ball is well greased when installed.

Countershaft

42 The countershaft front bearing was removed at the time of dismantling the transmission into major units.

43 The countershaft rear bearing was left in position in the adapter plate.

44 Withdraw the countershaft drive gear and extract the two Woodruff keys.

45 Check all components for wear, especially the gear teeth and shaft splines for chipping. Reinstall the Woodruff keys and the snap-ring.

46 Reassembly is a reversal of dismantling.

Input shaft (main drive gear)

47 Remove the snap-ring and spacer.

48 Withdraw the bearing using a two-leg puller or a press. Once removed (by means of its outer race), discard the bearing.

49 Press the new bearing onto the shaft, applying pressure to the center race only.

50 Reinstall the washer.

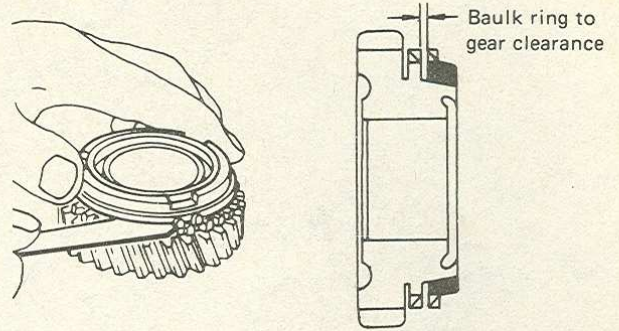
51 Several thicknesses of snap-rings are available for the main input shaft bearing, as listed in the Specifications. Choose a size that will eliminate bearing end play.

Oil seals

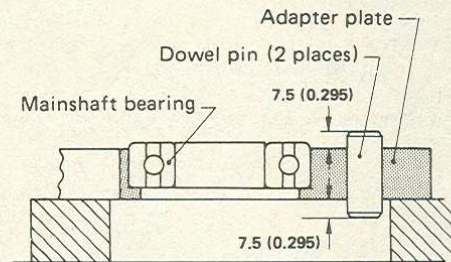
52 Pry out the oil seal from the rear extension and drive in a new one, with the seal lips facing inwards.

53 Reinstall the speedometer pinion sleeve O-ring seal.

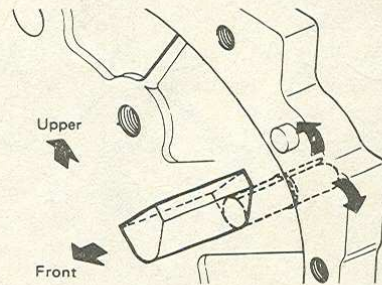
54 Reinstall the oil seal in the front cover by prying out the old one and driving in a new one with an appropriate sized socket.



6.38 The baulk ring should be checked for wear by mating it with its gear and measuring the gap with a feeler gauge



6.64a Install the dowel pin in the adapter plate so that it extends an equal distance above and below the plate



6.64b Install the oil gutter in the adapter plate and expand the rear side

Rear extension housing

55 Loosen the nut on the end of the striking rod lock pin, until it is half off the threads (see illustration 6.16).

56 Using the nut as a guide, drive the lock pin from the striking rod with a punch.

57 Slide the striking lever from the striking rod and withdraw the rod from the rear of the housing.

58 Check the rod and lever for wear or damage and replace if necessary. Replace the O-ring on the striking rod.

59 Inspect the bushing in the rear of the extension housing. If this bushing is worn or cracked, the entire rear extension housing must be replaced.

60 Reinstall the striking rod assembly by reversing the removal procedure.

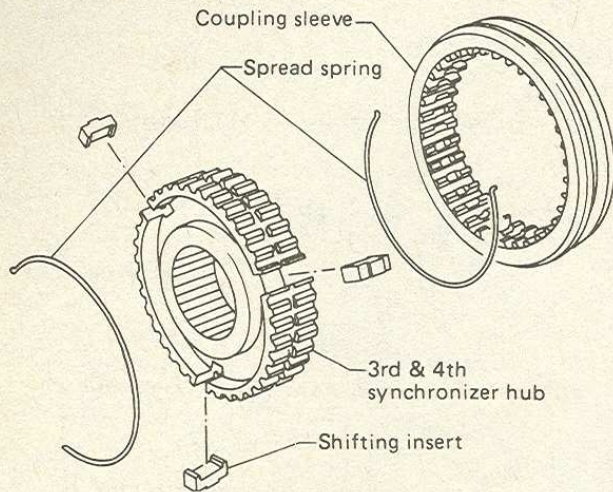
Reassembly

61 Before beginning to reassemble the transmission, the mainshaft and countershaft adapter plate bearings should be removed, examined and replaced if worn. To do this, unscrew the six screws retaining the bearing retainer plate to the adapter plate. The use of an impact driver will probably be required for this operation.

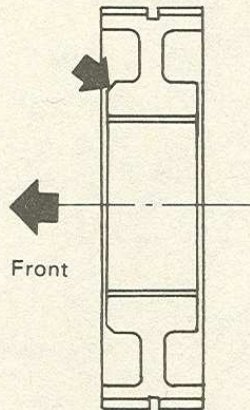
62 With the bearing retainer plate removed, press the mainshaft and countershaft bearings from the adapter plate. Apply pressure only to the outer races of the bearings.

63 Check the bearings for wear by first washing them in clean solvent and them drying in air. Spin them with your fingers, and if they are noisy or loose in operation, replace them.

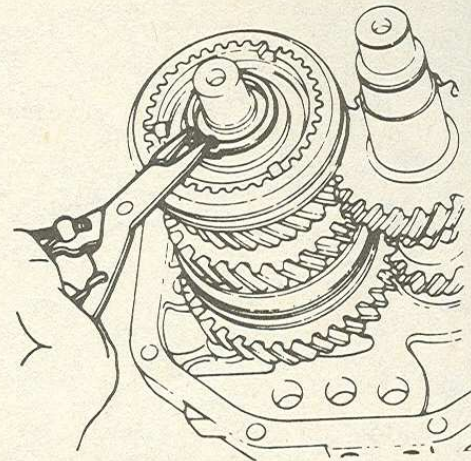
64 Check that the dowel pin and oil gutter are correctly positioned on the adapter plate (see illustrations).



6.72a Third and fourth gear synchronizer assembly



6.72b Pay attention to the installed direction of the synchronizer



6.73 Selecting and installing the proper snap ring will minimize end play in the mainshaft

65 Tap the mainshaft bearing lightly and squarely into position in the adapter plate.

66 Drive the reverse idler shaft into the adapter plate so that two-thirds of its length is projecting rearwards. Ensure that the cutout in the shaft is positioned to receive the edge of the bearing retainer plate.

67 Install the bearing retainer plate and tighten the screws to specifications.

68 Stake each screw in two places to keep them from loosening.

69 Tap the countershaft rear bearing into position in the adapter plate.

70 Press the mainshaft assembly into position in the bearing in the adapter plate. Support the rear of the bearing center race during this operation.

71 Press the countershaft assembly into position in the bearing in the adapter plate. Again, support the rear of the bearing center race during this operation.

72 Install the needle bearing, third gear, baulk ring and the third/fourth synchromesh unit onto the front of the mainshaft (see illustrations).

73 Install the thrust washer, then choose a snap-ring from the sizes listed in the Specifications that will minimize end play (see illustration).

74 Insert the needle pilot bearing in its recess at the end of the input shaft.

75 Mesh the countershaft drive gear with the fourth gear on the input shaft. Push the drive gear and input shaft onto the countershaft and mainshaft simultaneously, using Nissan tools ST2386000 and KV31100401 and a press, or use a piece of tubing to drive the countershaft gear into position while supporting the rear of the countershaft (see illustration).

76 Select a countershaft drive gear snap-ring from the sizes listed in the Specifications, so that the gear end play will be minimized (see illustration).

77 Using a socket, drive the front bearing onto the countershaft.

78 Install the reverse counter gear spacer onto the rear of the countershaft.

79 Install the snap-ring, thrust washer, needle bearing, reverse idler gear, reverse idler thrust washer and rear snap-ring onto the reverse idler shaft.

80 Onto the rear side of the mainshaft, install the synchronizer assembly, reverse gear, overdrive gear bushing, needle bearing and baulk ring.

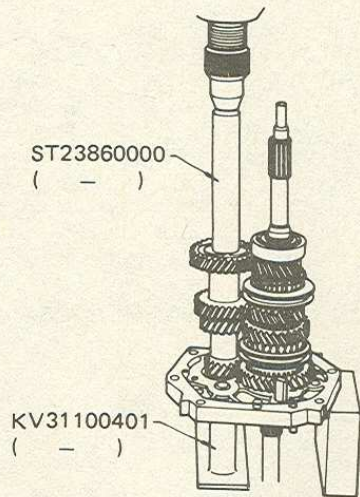
81 Install the reverse counter gear on the countershaft.

82 Mesh the overdrive gear with the overdrive counter gear and install them on their respective shafts, with the overdrive gear on the mainshaft and the overdrive counter gear on the countershaft.

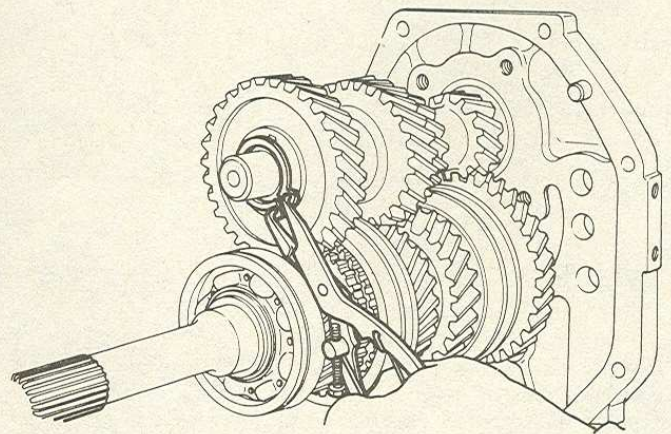
83 Apply grease to the steel ball and install it and the thrust washer onto the rear of the mainshaft.

84 Install a new locknut onto the rear of the mainshaft and torque it to specification. **Note:** In order to accurately tighten the nut to its torque specification, a wrench adapter should be used (see illustration). Used with the adapter, the torque reading on the wrench will not be accurate and should be converted to the correct torque by referring to the chart (see illustration).

85 Install the countershaft rear end bearing onto the countershaft.



6.75 A press and special tools are called for to press the counter shaft gear into position, but a piece of tubing can be used with a hammer to drive the gear into position



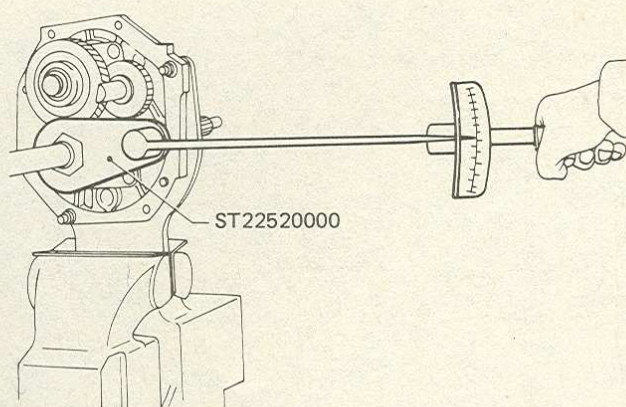
6.76 Select the correct snap ring to minimize end play

86 Install the countershaft locknut and torque it to specification.

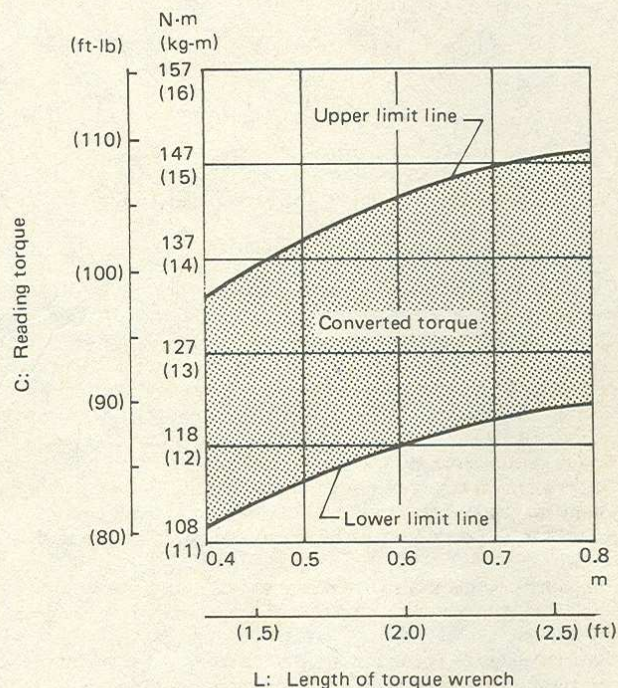
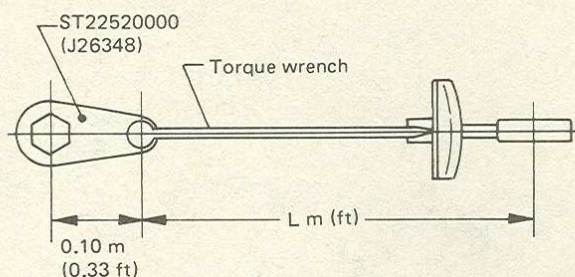
87 Use a hammer and punch to stake both the mainshaft and countershaft locknuts so they engage the grooves in their respective shafts.

88 Once again measure the gear end play, as described in Step 18.

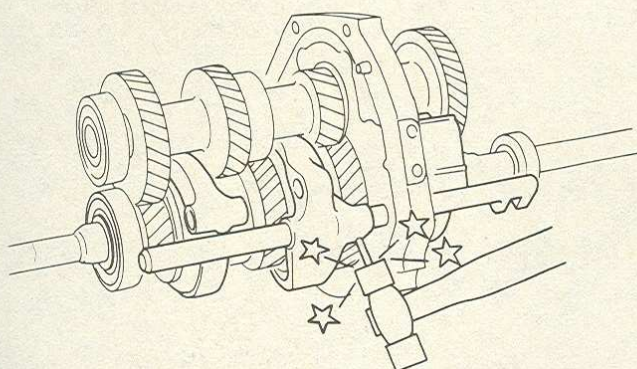
89 Fit a snap-ring onto the mainshaft and then install the overdrive mainshaft bearing.



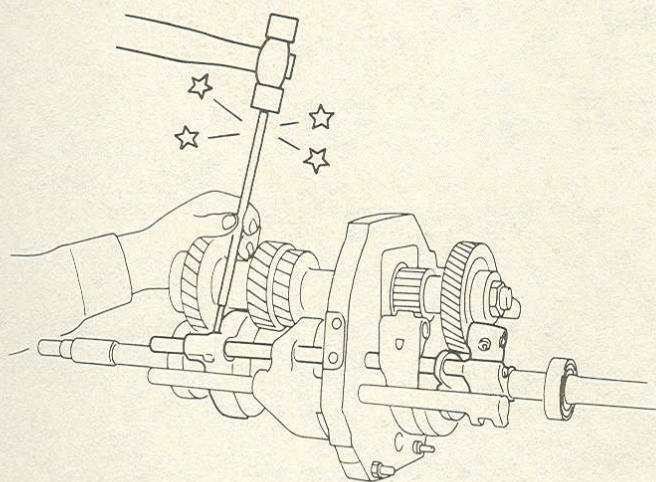
6.84a The mainshaft locknut should be tightened using a torque wrench and adapter



6.84b When tightening the mainshaft locknut, the true torque can be found by matching the torque reading on the wrench with the chart above



6.94 Drive in a new retaining pin



6.96 Drive in the retaining pin for the third and fourth gear selector rod

90 Choose a snap-ring from the sizes listed in the Specifications to eliminate end play of the mainshaft rear bearing.

91 Install the next snap-ring, then grease the steel ball and install the ball and the speedometer drive gear onto the mainshaft. Install the last snap-ring.

92 Locate the first/second shift fork onto the first/second synchronizer unit. The long end of the shift fork must be towards the countershaft. Locate the third/fourth shift fork onto the third/fourth synchronizer unit. The long end of the shift fork must be the opposite side to the first/second shift fork.

93 Locate the overdrive reverse shift fork onto the overdrive synchronizer so that the upper rod hole is in line with the third/fourth shift fork.

94 Slide the first/second selector rod through the adapter plate and into the first/second shift fork. Align the hole in the rod with the hole in the fork and drive in a new retaining pin (see illustration).

95 Align the notch in the first/second selector rod with the check ball bore, then install the check ball and spring and screw in the check ball plug. Apply thread sealant to the check ball plug.

96 Invert the adapter plate assembly (hold the third/fourth and OD/reverse shift forks in position) so that the check ball plug installed in Step 95 is lowermost. Drop two interlock balls into the third/fourth detent ball plug hole and, using a suitable thin probe, push them up against the first/second selector rod. If the adapter plate is correctly positioned, the interlock balls will drop into position. Slide the third/fourth selector rod through the upper hole of the OD/reverse shift fork and the adapter plate, ensuring that the interlock balls are held between this selector rod and the first/second selector rod, and into the third/fourth shift fork. Align the holes in the shift fork and selector rod, and drive in a new retaining pin (see illustration). Install a check ball, spring and check ball plug (with thread sealant applied) to the third/fourth check ball plug bore. Ensure that the notch in the third/fourth selector rod is aligned with the check ball plug bore before assembling the check ball.

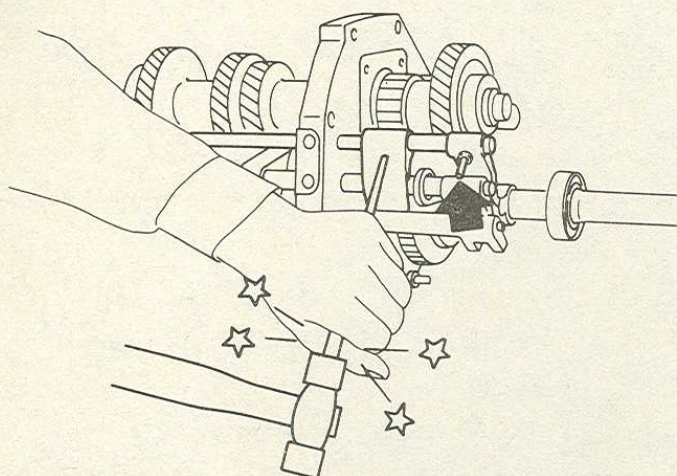
97 Drop two interlock balls into the remaining ball plug bore, ensuring that they locate against the third/fourth selector rod. Slide the overdrive/reverse selector rod through the overdrive reverse shift fork and into the adapter plate. Ensure that the two interlock balls are held in position between the third/fourth selector rod and the overdrive/reverse selector rod, sliding the overdrive/reverse selector rod into the adapter plate until the notch in the selector rod aligns with the check ball plug bore. Insert the check ball, spring and check ball plug as before. Drive

in a new retaining pin to retain the overdrive/reverse shift fork to the overdrive/reverse selector rod (see illustration).

98 Tighten the three detent ball plugs to the specified torque.

99 Thoroughly oil the entire assembly and check to see that the selector rods operate correctly and smoothly.

100 Clean the mating faces of the adapter plate and the transmission



6.97 Install the retaining pin for the overdrive/reverse shift fork to the overdrive/reverse selector rod

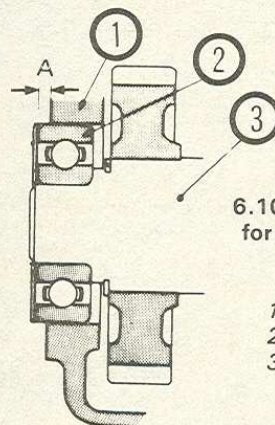
casing and apply gasket sealant to both surfaces.

101 Tap the transmission casing into position on the adapter plate, using a soft face hammer, taking particular care that it engages correctly with the input shaft bearing and countershaft front bearing.

102 Fit the outer snap-ring to the input shaft bearing.

103 Clean the mating faces of the adapter plate and rear extension housing and apply gasket sealant.

104 Arrange the shift forks in their neutral mode and lower the rear extension housing onto the adapter plate so that the striking lever engages correctly with the selector rods.

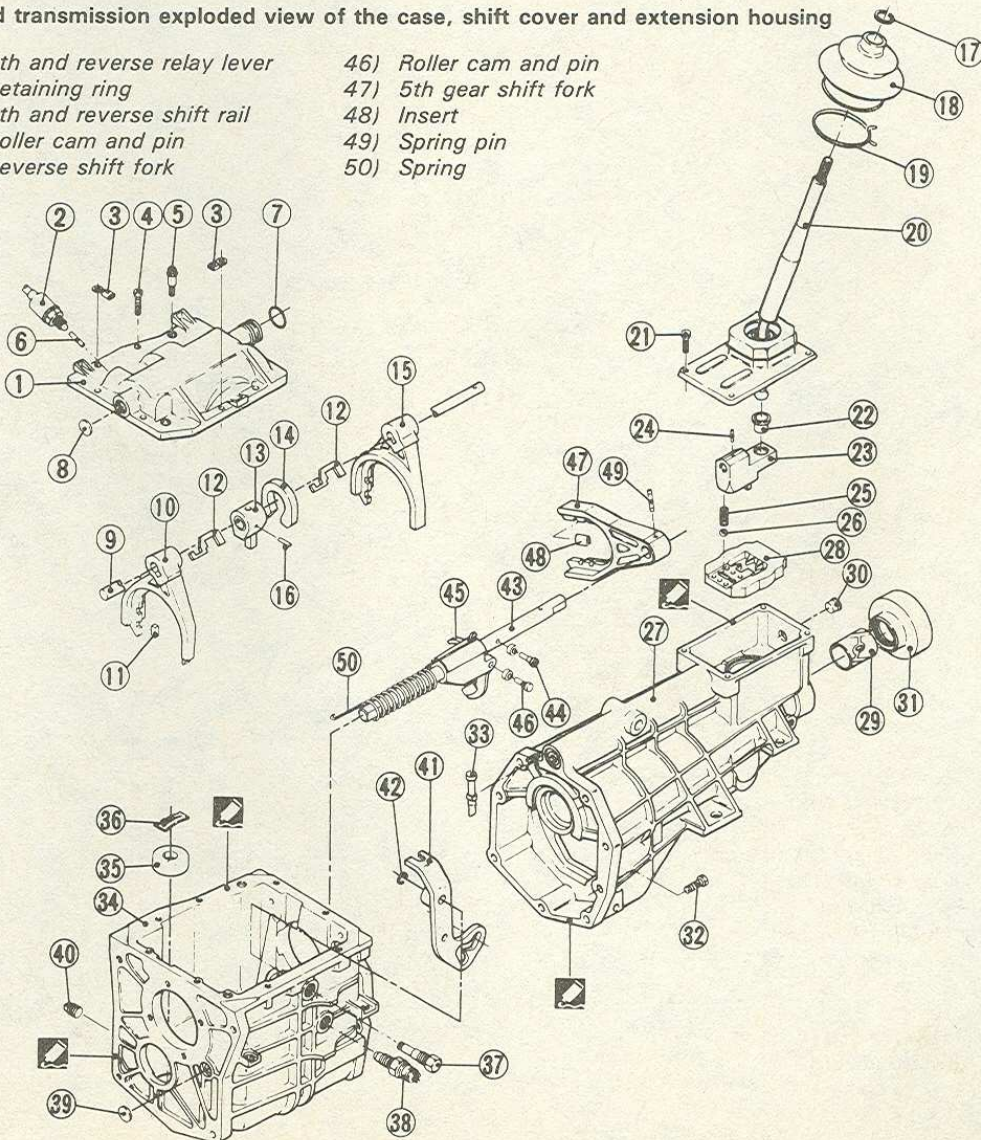


6.106 Measurement location (A) for selection of the countershaft front bearing shim

- 1 Transmission case
- 2 Counter gear front bearing
- 3 Counter gear

7.1a Model BW T-5 FS5R90A 5-speed transmission exploded view of the case, shift cover and extension housing

- | | | |
|------------------------------------|---------------------------------|-------------------------|
| 1) Case cover | 41) 5th and reverse relay lever | 46) Roller cam and pin |
| 2) Neutral switch | 42) Retaining ring | 47) 5th gear shift fork |
| 3) Wiring clip | 43) 5th and reverse shift rail | 48) Insert |
| 4) Bolt | 44) Roller cam and pin | 49) Spring pin |
| 5) Shoulder bolt | 45) Reverse shift fork | 50) Spring |
| 6) Pin | | |
| 7) O-ring | | |
| 8) Welsh plug | | |
| 9) Shifter shaft | | |
| 10) 3-4 shift fork | | |
| 11) Shift fork insert | | |
| 12) Selector plate | | |
| 13) Control selector arm | | |
| 14) Interlock plate | | |
| 15) 1-2 shift fork | | |
| 16) Spring pin | | |
| 17) Boot retainer | | |
| 18) Boot | | |
| 19) Boot retainer | | |
| 20) Control lever housing assembly | | |
| 21) Control housing screw | | |
| 22) Damper sleeve | | |
| 23) Offset lever | | |
| 24) Spring pin | | |
| 25) Detent spring | | |
| 26) Ball | | |
| 27) Extension housing | | |
| 28) Detent and guide plate | | |
| 29) Bushing | | |
| 30) Cup plug | | |
| 31) Oil seal | | |
| 32) Flanged bolt | | |
| 33) Breather | | |
| 34) Case | | |
| 35) Magnet | | |
| 36) Clip | | |
| 37) Reverse pivot pin | | |
| 38) Reverse lamp switch | | |
| 39) Welsh plug | | |
| 40) Pipe plug | | |



105 Fit the bolts which secure the sections of the transmission together and tighten them to the specified torque.

106 Measure the amount by which the countershaft front bearing protrudes from the transmission casing front face. Use feeler gauge blades for this and then select the appropriate shims after reference to the table found in Specifications (see illustration):

107 Install the shim using a dab of thick grease, then fit the front cover to the transmission casing (within the clutch bellhousing) complete with a new gasket and taking care not to damage the oil seal as it passes over the input shaft splines.

108 Tighten the securing bolts to the specified torque, making sure that the bolt threads are coated with gasket sealant to prevent oil seepage.

109 Complete the reassembly by reversing the procedures described in Steps 1 through 8 of this Section.

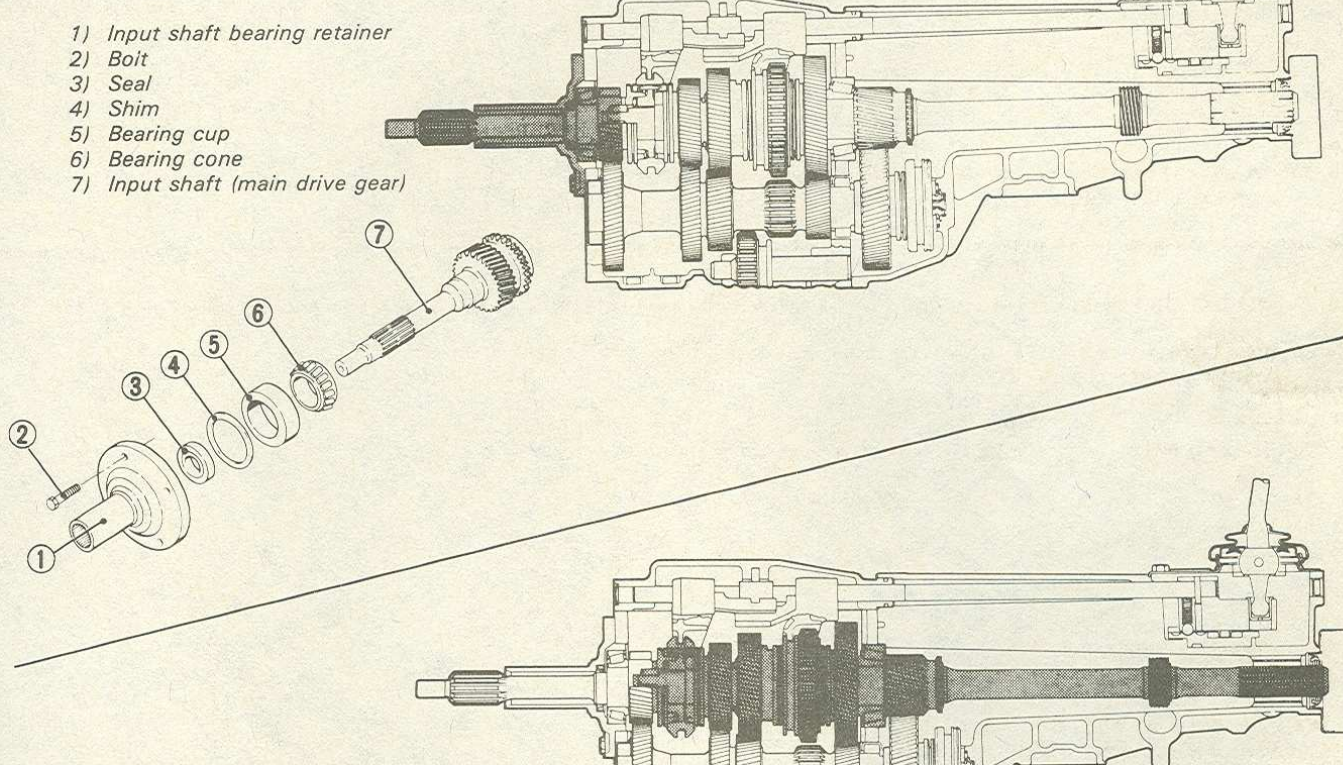
7 5-speed transmission (BW T-5 FS5R90A) — overhaul

Refer to illustrations 7.1a, 7.1b, 7.1c, 7.1d, 7.1e, 7.3, 7.6, 7.7, 7.8, 7.14, 7.19, 7.21 and 7.35

Disassembly

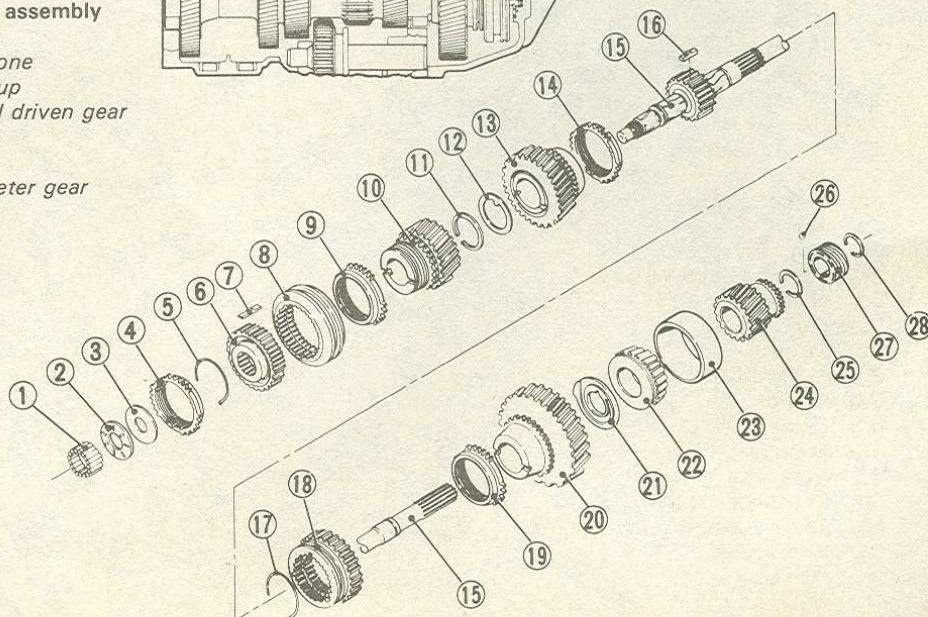
- 1 Study the exploded view drawings of the transmission.
- 2 Remove the offset lever roll pin using a pin punch and hammer.
- 3 Remove the extension housing-to-transmission case bolts. Remove

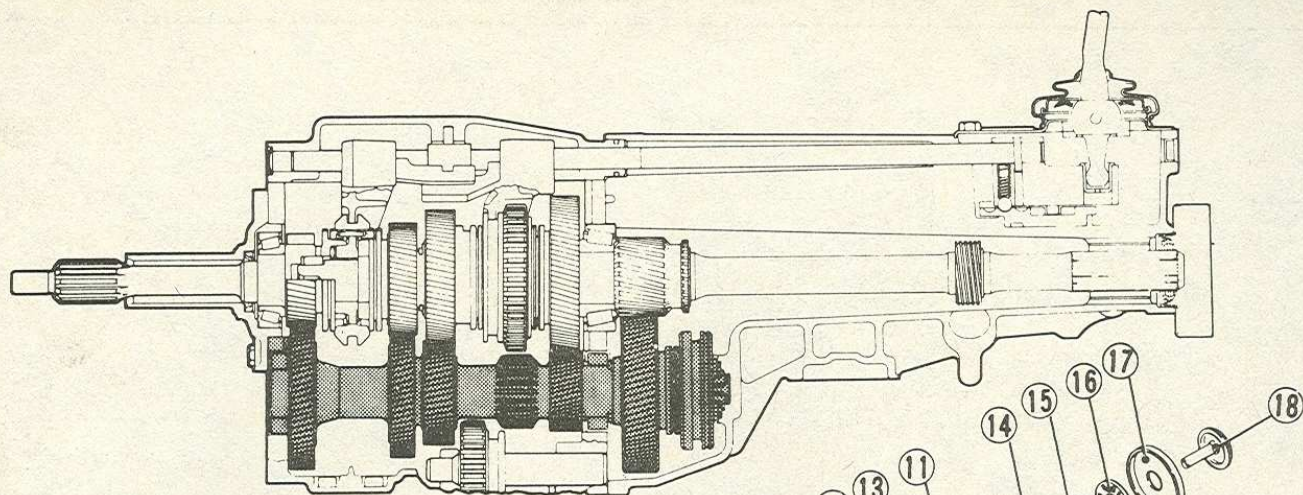
7.1b Exploded view of the input shaft assembly



7.1c Exploded view of the output shaft assembly

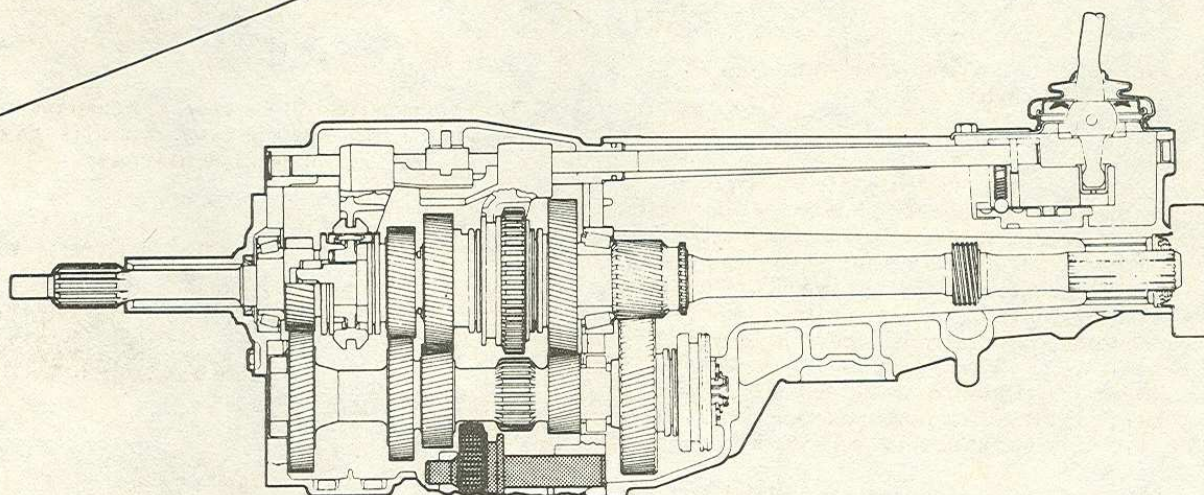
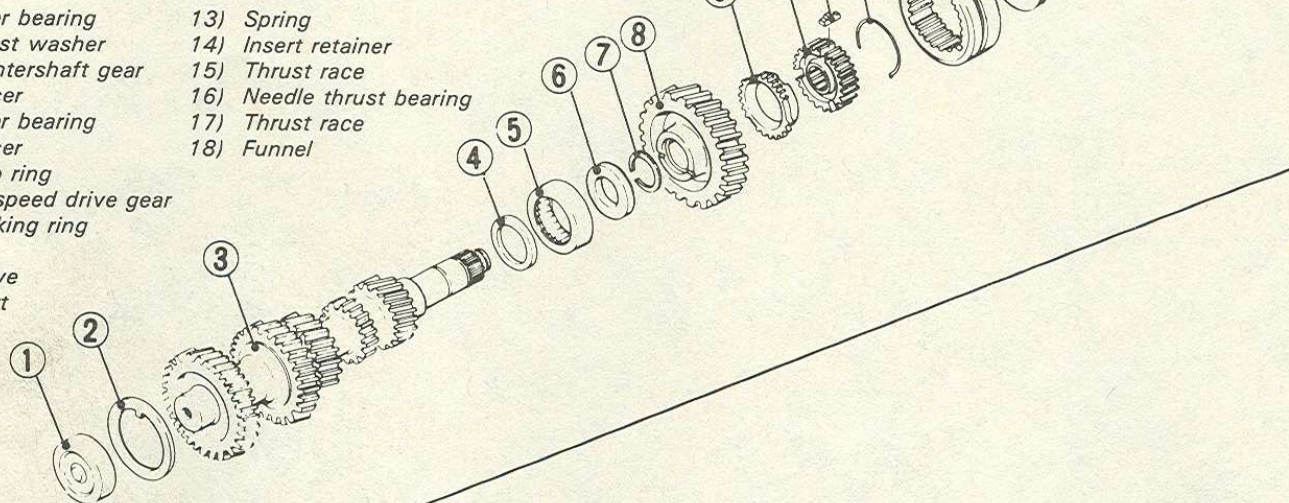
- | | |
|-----------------------------------|---------------------------|
| 1) Needle rollers | 22) Bearing cone |
| 2) Needle thrust bearing | 23) Bearing cup |
| 3) Thrust bearing race | 24) 5th speed driven gear |
| 4) Blocking ring | 25) Snap ring |
| 5) Spring | 26) Ball |
| 6) Hub | 27) Speedometer gear |
| 7) Insert | 28) Snap ring |
| 8) Sleeve | |
| 9) Blocking ring | |
| 10) 3rd speed gear | |
| 11) Snap ring | |
| 12) 2nd speed thrust washer | |
| 13) 2nd speed gear | |
| 14) Blocking ring | |
| 15) Output shaft and hub assembly | |
| 16) Insert | |
| 17) Spring | |
| 18) Reverse sliding gear | |
| 19) Blocking ring | |
| 20) 1st speed gear | |
| 21) Thrust washer | |





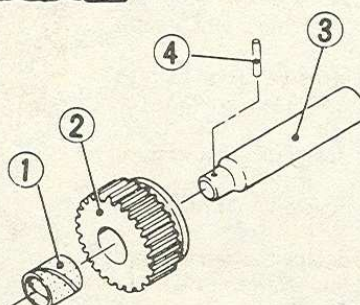
7.1d Exploded view of the countershaft assembly

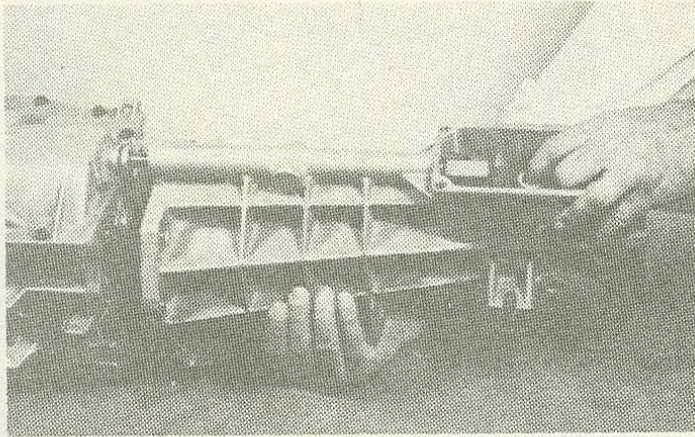
- | | |
|-------------------------|---------------------------|
| 1) Roller bearing | 13) Spring |
| 2) Thrust washer | 14) Insert retainer |
| 3) Countershaft gear | 15) Thrust race |
| 4) Spacer | 16) Needle thrust bearing |
| 5) Roller bearing | 17) Thrust race |
| 6) Spacer | 18) Funnel |
| 7) Snap ring | |
| 8) 5th speed drive gear | |
| 9) Blocking ring | |
| 10) Hub | |
| 11) Sleeve | |
| 12) Insert | |



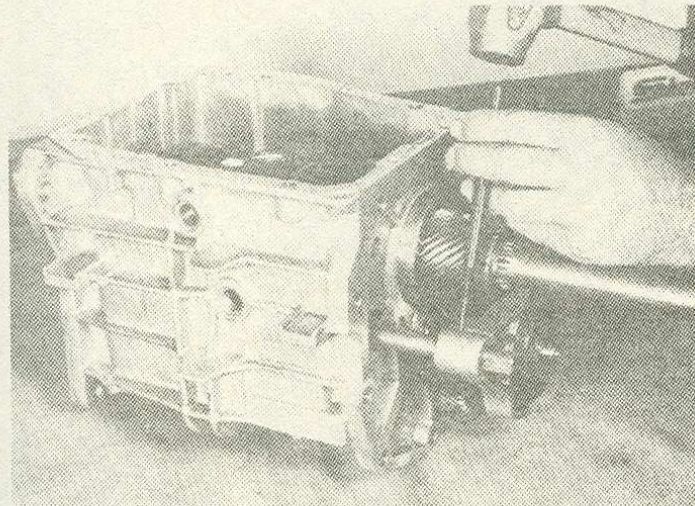
7.1e Exploded view of the reverse idler assembly

- | |
|--------------------------|
| 1) Reverse idler bushing |
| 2) Reverse idler gear |
| 3) Reverse idler shaft |
| 4) Spring pin |

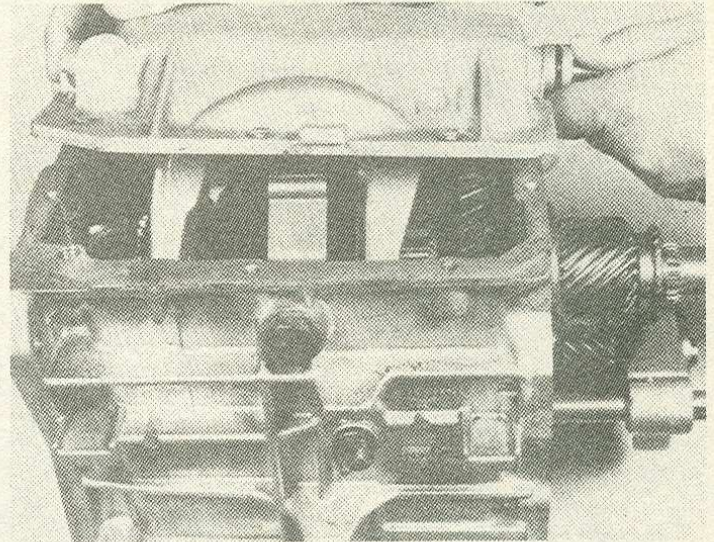




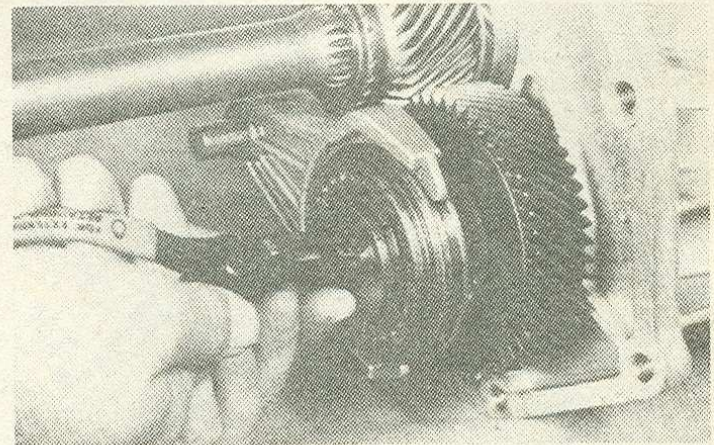
7.3 Remove the retaining bolts and separate the extension housing from the case



7.7 Drive out the roll pin to remove the overdrive (5th gear) shift fork



7.6 Remove the cover bolts and slide the cover to the right side of the case, then lift it off



7.8 From the rear of the case, use snap ring pliers and remove the snap ring and thrust race from the overdrive (5th gear) synchronizer

the housing and offset lever as an assembly (see illustration).

4 Remove the detent ball, spring and roll pin from the offset lever.

5 Remove the plastic funnel, thrust bearing race and thrust bearing from the end of the countershaft or the inside of the extension housing.

6 Remove the transmission cover bolts and remove the cover by sliding the cover to the right side of the case and lifting it off (see illustration). Note the location of the dowel-type alignment bolts for assembly reference.

7 Remove the roll pin from the fifth gear shift fork using a hammer and punch (see illustration). **Note:** To prevent damage to the reverse shift rail, place a wood block under the fifth gear shift fork during roll pin removal.

8 Remove the fifth gear synchronizer snap-ring and shift fork (see illustration). Remove the fifth gear synchronizer assembly and detach fifth gear from the rear of the countershaft.

9 Remove the insert retainer, insert springs and inserts from the fifth gear synchronizer sleeve. Mark the position of the sleeve and hub for assembly reference.

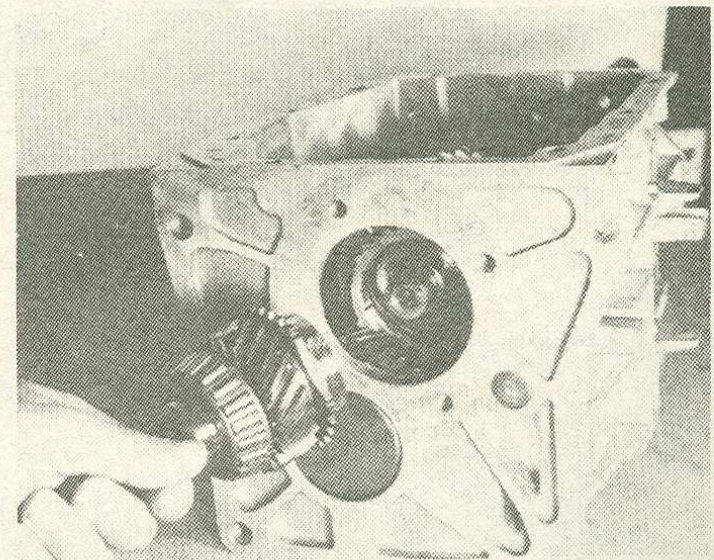
10 Remove the snap-ring and separate the fifth speed driven gear from the rear of the output shaft.

11 Punch alignment marks on the front bearing cap and the transmission case for assembly reference.

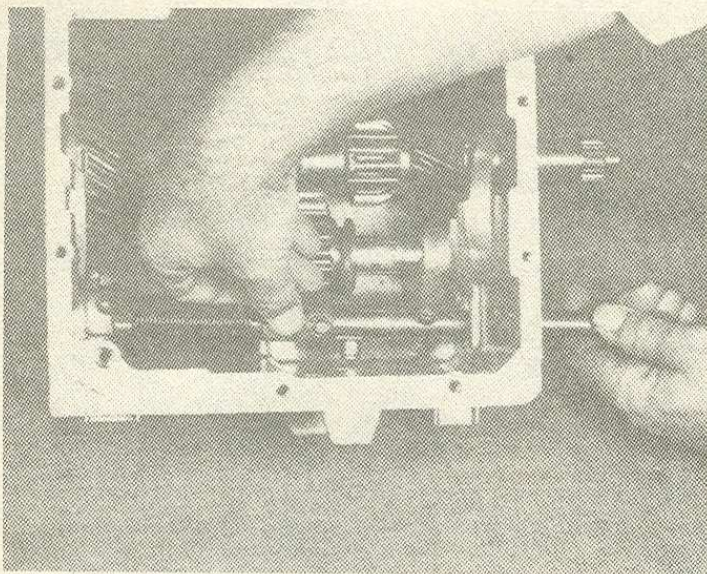
12 Remove the bearing cap mounting bolts and detach the bearing cap.

13 Remove the bearing race and end play shims from the cap. Pry out the bearing cap oil seal with a screwdriver.

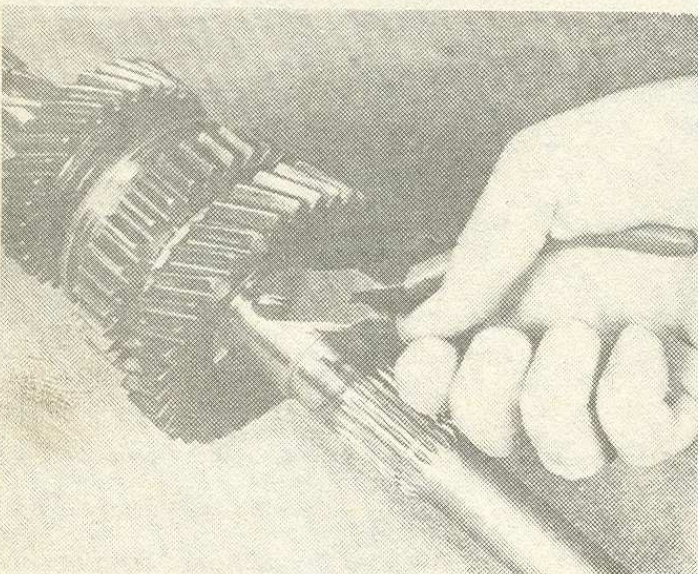
14 Rotate the clutch shaft until the gear flat faces the countershaft, then remove the clutch shaft from the transmission case (see illustration). Remove the clutch shaft needle bearings, thrust bearing and race.



7.14 Position the flat area of the main drive gear toward the counter gear and pull the input shaft and main drive gear assembly through the front of the case

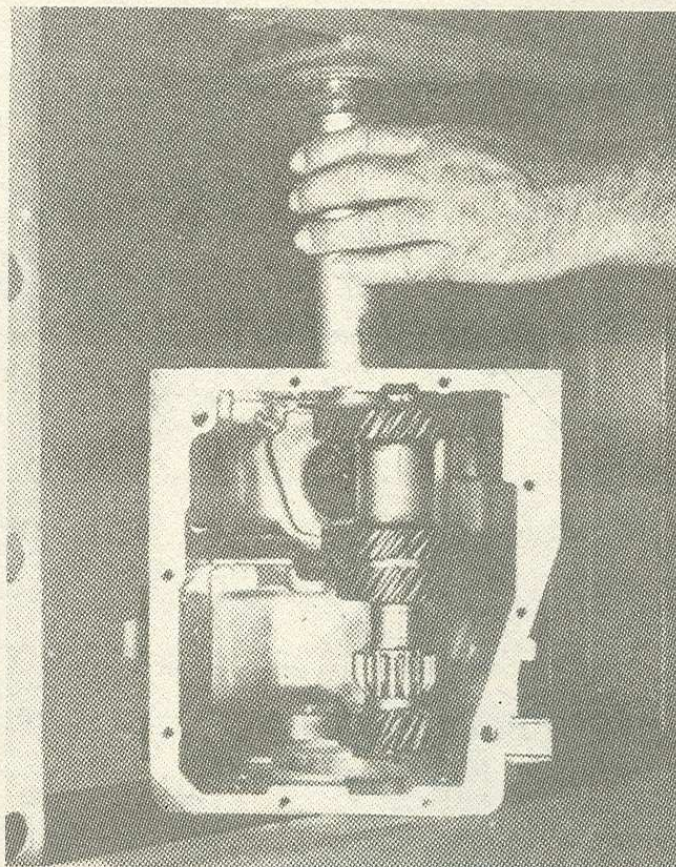


7.19 Remove the overdrive and reverse shift rail, reverse shift fork and the overdrive and reverse relay lever and spring as an assembly



7.35 Use diagonal cutters to remove the first speed gear assembly roll pin

- 15 Remove the output shaft rear bearing race and lift the shaft assembly out of the case.
- 16 Unhook the overcenter link spring from the rear of the case. A home made spring removal tool made of welding rod or wire would be helpful here.
- 17 Remove the reverse lever C-clip.
- 18 Rotate the reverse shift rail until it disengages from the reverse lever and remove the rail from the rear of the case.
- 19 Remove the reverse lever pivot pin, disengage the reverse lever from the idler gear and remove the reverse lever and fork assembly from the transmission case (see illustration).
- 20 Remove the rear countershaft snap-ring and spacer.
- 21 Using a press and a brass drift inserted through the clutch shaft opening in the front of the case, carefully press the countershaft assembly to the rear to remove the countershaft bearing (see illustration).
- 22 Move the countershaft assembly to the rear and lift it out of the transmission case.
- 23 Remove the countershaft rear bearing spacer.
- 24 Remove the idler shaft roll pin.



7.21 Use a press to remove the countershaft bearing

- 25 Remove the idler shaft and gear from the transmission case.
- 26 Using a press, remove the countershaft front bearing from the case if replacement is necessary.
- 27 Remove the clutch shaft front bearing.
- 28 Remove the rear extension housing seal using a flat drift and a hammer.
- 29 Remove the thrust bearing washer from the output shaft.
- 30 Remove the third/fourth synchronizer assembly and blocking ring. Mark the sleeve and hub for assembly reference.
- 31 Remove the third/fourth synchronizer insert springs and inserts and remove the sleeve from the hub.
- 32 Remove third gear from the output shaft.
- 33 Remove the second gear snap-ring, tabbed thrust washer and second gear from the shaft.
- 34 Remove the output shaft bearing.
- 35 Remove the first gear thrust washer, roll pin (using diagonal cutters) (see illustration), first gear and blocking ring.
- 36 Scribe alignment marks on the first/second gear synchronizer sleeve and the output shaft hub for assembly reference.
- 37 Remove the insert spring and inserts from the first/reverse sliding gear and remove the gear from the output shaft hub. **Note:** *The first/second/reverse hub is part of the output shaft and is not removable.*
- 38 Place the selector arm plates and shift rail in the Neutral (centered) position.
- 39 Rotate the shift rail counterclockwise until the selector arm disengages from the selector arm plates and the selector arm roll pin is accessible.
- 40 Pull back on the shift rail until the selector arm contacts the first/second shift fork.
- 41 Remove the roll pin using a 3/16-inch pin punch and remove the shift rail.
- 42 Remove the shift forks, selector arm plates, selector arm and interlock plate.
- 43 Pry out the shift rail oil seal and O-ring using a screwdriver.

- 44 Remove the shift rail plug using a hammer and punch.
- 45 Remove the nylon inserts and selector arm plates from the shift forks, noting their position for assembly reference.

Inspection

46 Wash the transmission components thoroughly with solvent. Inspect the transmission case for cracks in the bores, sides, bosses and bolt holes and for stripped threads in the bolt holes. Check the gear train and shift mechanism for broken, chipped or worn gear teeth, bent or broken inserts, weak or broken insert springs, damaged roller or needle bearings and bearing bores in the countershaft and hub, clutch shaft or reverse idler gear shaft. Check the snap-rings for distortion and lack of tension. Inspect the front and rear bearings for galling, damage and roughness. Inspect the shift mechanism for worn, damaged or bent inserts, forks, rails, arms, plates, interlocks and levers.

Reassembly

- 47 Begin assembling the cover by first installing the nylon inserts and selector arm plates in the shift forks.
- 48 Coat the edges of the shift rail plug with sealer and install the plug.
- 49 Coat the shift rail and shift rail bores with petroleum jelly and insert the rail into the cover until the end is flush with the inside edge of the cover.
- 50 Position the first/second shift fork in the cover and push the shift rail through the fork. **Note:** *The first/second shift fork is the larger of the two shift forks.*
- 51 Position the selector arm and interlock plate and insert the shift rail. The widest part of the plate faces away from the cover and the roll pin faces down and toward the rear of the cover.
- 52 Position the third/fourth shift fork with the selector arm plate under the first/second shift fork selector arm plate.
- 53 Insert the shift rail through the third/fourth shift fork and into the shift rail bore in the cover.
- 54 Rotate the shift rail until the selector arm plate at the forward end faces away from, but parallel to, the cover.
- 55 Align the roll pin holes and install the roll pin. Be sure it is installed flush with the selector arm surface.
- 56 Install the O-ring in the shift rail oil seal groove.
- 57 Install the shift rail seal by first placing an oil seal protector over the threaded end of the shift rail.
- 58 Lubricate the lip of the oil seal and slide it over the protector and onto the shift rail.
- 59 Seat the oil seal in the transmission cover using an oil seal installer tool or an appropriate sized socket as an equivalent.
- 60 Coat the output shaft and gear bores with transmission lubricant.
- 61 Install the first/second synchronizer sleeve on the output shaft using the reference marks for alignment.
- 62 Install the three synchronizer inserts and two insert springs in the first/second synchronizer sleeve. The insert spring tangs engage in the same synchronizer insert, but the open ends of the springs face away from each other.
- 63 Install the blocking ring and second gear on the output shaft.
- 64 Install the thrust washer and second gear snap-ring. Be sure the washer tab is seated in the output shaft notch.
- 65 Install the blocking ring and first gear on the output shaft.
- 66 Install the first gear roll pin.
- 67 Install the rear bearing on the output shaft using a bearing installer and a press.
- 68 Install the first gear thrust washer.
- 69 Install third gear, the third and fourth gear synchronizer hub inserts and the sleeve on the output shaft. Be sure that the portion of the hub with the extended hose is toward the front.
- 70 Install the thrust bearing washer on the output shaft.
- 71 Coat the countershaft front bearing outer cage with locking compound and install the countershaft front bearing flush with the case using an arbor press.
- 72 Coat the countershaft thrust washer with petroleum jelly. Install the washer with the tab corresponding to the depression in the case.
- 73 Stand the case on end and install the countershaft in the front bearing bore.
- 74 Install the countershaft rear bearing spacer.
- 75 Coat the rear bearing with petroleum jelly and install it with a bearing installer and a sleeve tool. The installed bearing should extend beyond the case surface. See the Specifications for the installed height.

- 76 Position the reverse idler gear and install the idler shaft from the rear of the case. Install the roll pin.
- 77 Install the output shaft.
- 78 Install the front clutch shaft bearing on the clutch shaft using a bearing installer and a press.
- 79 Coat the roller bearings with petroleum jelly and install them in the clutch shaft.
- 80 Install the clutch bearing and race in the clutch shaft.
- 81 Install the rear output shaft bearing race cap.
- 82 Install the fourth gear blocking ring.
- 83 Install the clutch shaft, engaging it in the third/fourth synchronizer sleeve and blocking ring.
- 84 Install the front bearing cap oil seal.
- 85 Install the front bearing race in the front bearing cap, but do not yet install the preload shims.
- 86 Temporarily install the front bearing cap.
- 87 Install the reverse lever, pivot bolt and C-clip. Coat the pivot bolt threads with non-hardening gasket sealer. Be sure the reverse lever fork engages the idler gear.
- 88 Install the fifth speed driven gear and snap-ring.
- 89 Install fifth gear on the countershaft.
- 90 Insert the reverse rail from the rear of the case and rotate it until it engages in the fifth speed reverse lever.
- 91 Install the reverse lever overcenter link spring.
- 92 Using reference marks for alignment, assemble the fifth gear synchronizer sleeve, insert springs and insert retainer.
- 93 Install the plastic inserts on each side of the fifth speed shift fork.
- 94 Place the fifth gear synchronizer assembly on the fifth speed shift fork and slide them onto the countershaft and reverse rail.
- 95 Place a wood block under the rail and fork assembly and install the roll pin.
- 96 Install the thrust race against the fifth speed synchronizer hub and install the snap-ring.
- 97 Coat the thrust race and bearing with petroleum jelly and install the bearing against the thrust race.
- 98 Install the lipped thrust race over the thrust bearing and install the plastic funnel in the end of the countershaft gear.
- 99 Temporarily install the extension housing.
- 100 Turn the transmission case on end and mount a dial indicator on the extension housing with the indicator stylus on the end of the output shaft.
- 101 Rotate the output shaft and zero the dial indicator.
- 102 Pull up on the output shaft until the end play is removed. Read the dial indicator and use the dimension to determine the thickness of the bearing preload shim.
- 103 Select a shim pack to remove the end play. See the Specifications for shim sizes.
- 104 Set the transmission down on its side and remove the bearing cap and race.
- 105 Add the necessary shims to the bearing cap and install the clutch shaft bearing race in the cap.
- 106 Apply some non-hardening gasket sealer to the case mating surface of the front bearing cap. Install the cap using the alignment marks and tighten the attaching bolts to specifications.
- 107 Recheck the end play. There must be no end play.
- 108 Remove the extension housing.
- 109 Move the shift forks and synchronizer rings to the Neutral position.
- 110 Apply non-hardening gasket sealer to the cover mating surfaces of the transmission case. Lower the cover assembly while aligning the shift forks and synchronizer sleeves. Center the cover to engage the reverse lever and install the two dowel bolts.
- 111 Install the remaining cover bolts and tighten them to meet specifications. Apply non-hardening gasket sealer to the extension housing mating surface of the transmission case and install the extension housing to a position where the shift rail just enters the shift cover opening.
- 112 Install the offset lever and spring with the detent ball in the neutral guide plate detent.
- 113 Install the extension housing bolts and tighten them to meet specifications.
- 114 Install the roll pin and the damper sleeve in the offset lever.
- 115 Coat the backup light switch with non-hardening gasket sealer and install the switch in the case.
- 116 Refer to the Specifications and fill the case with the proper type and amount of gear lubricant.
- 117 Install the transmission (Section 3).

8 Back-up light switch — checking and replacement

- 1 Disconnect the negative cable at the battery. Place the cable out of the way so it cannot accidentally come in contact with the negative terminal of the battery.
- 2 Place the transmission in the Reverse position.
- 3 Raise the vehicle and support it securely on jackstands.

- 4 Locate the back up wire on the side of the transmission.
- 5 Disconnect the electrical contact leads from the switch.
- 6 Place the leads of an ohm meter onto the terminals of the switch and the meter should show continuity. Have an assistant shift the shifter through the gears and check for continuity. There should be no continuity except in Reverse.
- 7 If the switch fails the test, replace it by unscrewing it from the transmission case and replacing it with a new one.