

AX 15 MANUAL TRANSMISSION

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GENERAL INFORMATION

The AX 15 is a 5-speed, synchromesh, manual transmission. Fifth gear is an overdrive range with a ratio of 0.79:1. The shift mechanism is integral and mounted in the shift tower portion of the adapter housing (Fig. 1).

An adapter housing is used to attach the transmission to the transfer case on 4-wheel drive models. A standard extension housing is used on 2-wheel drive models.

The AX 15 is used in XJ and YJ models with a 4.0L engine. The AX 15 is designed for use with either two-wheel drive or four-wheel drive applications.

TRANSMISSION IDENTIFICATION

The AX 15 identification code numbers are on the bottom surface of the transmission gear case (Fig. 2).

The first number is year of manufacture. The second and third numbers indicate month of manufacture.

The next series of numbers is the transmission serial number.

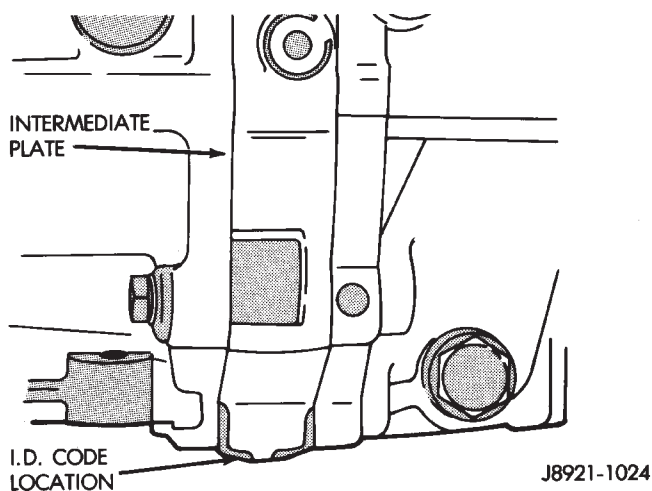


Fig. 2 Identification Code Number Location

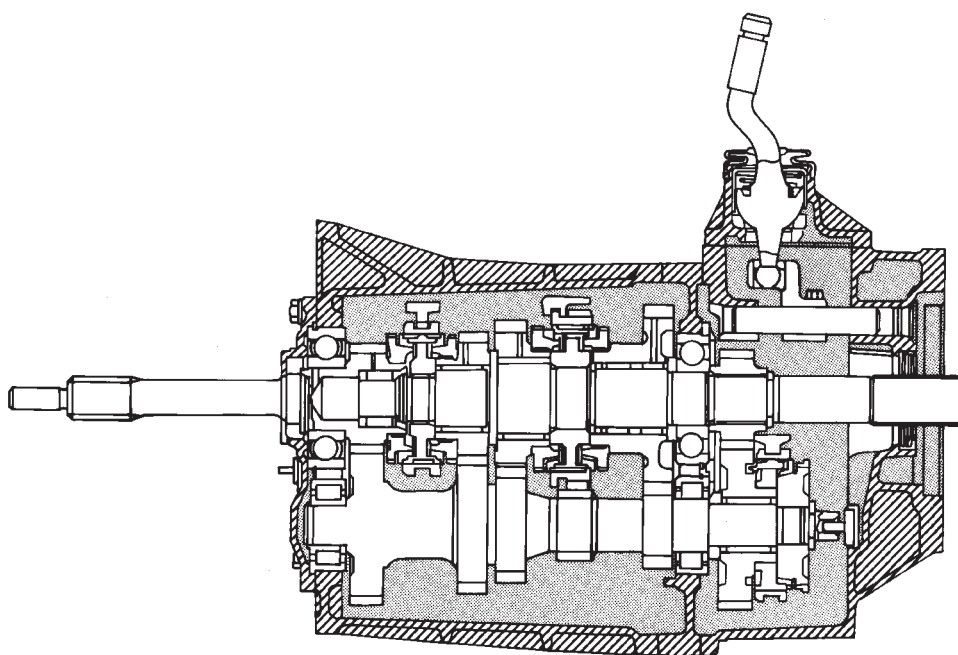


Fig. 1 AX 15 Manual Transmission

TRANSMISSION SHIFT PATTERN

The AX 15 shift pattern is shown in Figure 3. First and second and third and fourth gear ranges are in line for improved shifting. Fifth and reverse gear ranges are also in line at the extreme right of the pattern (Fig. 3).

The AX 15 is equipped with a reverse lockout mechanism. The shift lever must be moved through the Neutral detent before making a shift to reverse.

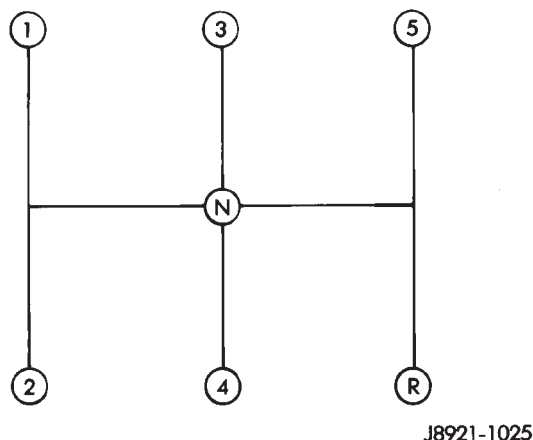


Fig. 3 AX 15 Shift Pattern

TRANSMISSION LUBRICANT

Recommended lubricant for AX 15 transmissions is Mopar 75W-90, API Grade GL-5 gear lubricant, or equivalent.

Correct lubricant refill or top-off level is to the bottom edge of the fill plug hole.

Lubricant capacity is:

- 3.10 liters (3.27 qts.) in 4-wheel drive models.
- 3.15 liters (3.32 qts.) in 2-wheel drive models.

TRANSMISSION SWITCH AND PLUG LOCATIONS

The fill plug is at the driver side of the gear case (Fig. 4).

The drain plug and backup light switch are on the passenger side of the gear case (Fig. 5).

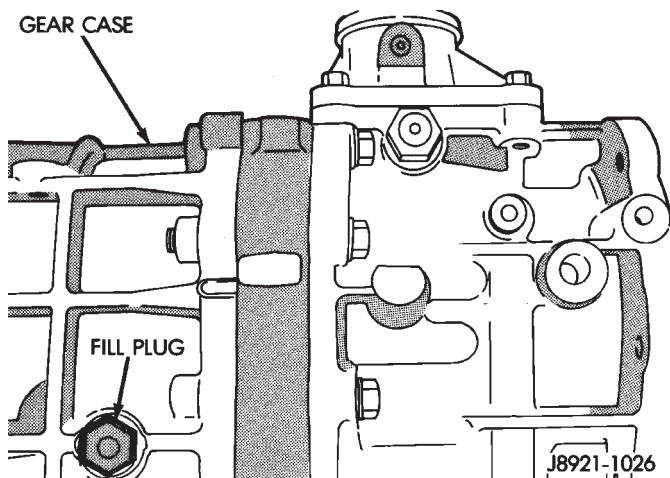


Fig. 4 Fill Plug Location

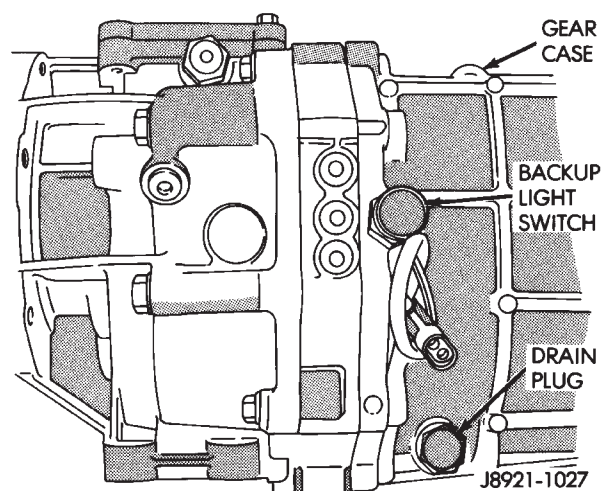


Fig. 5 Drain Plug And Backup Light Switch Location

TRANSMISSION GEAR RATIOS

The transmission gear ratios are as follows:

- First gear - 3.83:1
- Second gear - 2.33:1
- Third gear - 1.44:1
- Fourth gear - 1.00:1
- Fifth gear - 0.79:1
- Reverse - 4.22:1

SERVICE DIAGNOSIS

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

Leaks can occur at the mating surfaces of the gear case, intermediate plate and adapter or extension housing, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at the rear of the extension or adapter housing will be from the housing oil seals. Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non-recommended sealer.

A leak at the front of the transmission will be from either the front bearing retainer or retainer seal. Lubricant may be seen dripping from the clutch housing after extended operation. If the leak is severe, it may also contaminate the clutch disc causing slip, grab and chatter.

Transmissions filled from air or electrically powered lubricant containers can be underfilled. This generally happens when the container delivery mechanism is improperly calibrated. Always check the lubricant level after filling to avoid an under fill condition.

A correct lubricant level check can only be made when the vehicle is level; use a drive-on hoist to ensure this. Also allow the lubricant to settle for a

minute or so before checking. These recommendations will ensure an accurate check and avoid an under-or-overfill condition.

HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper or contaminated lubricants, component damage, incorrect clutch adjustment, or by a damaged clutch pressure plate or disc.

Substantial lubricant leaks can result in gear, shift rail, synchro and bearing damage. If a leak goes undetected for an extended period, the first indications of a problem are usually hard shifting and noise.

Incorrect or contaminated lubricants can also contribute to hard shifting. The consequence of using non-recommended lubricants is noise, excessive wear, internal bind and hard shifting.

Improper clutch release is a frequent cause of hard shifting. Incorrect adjustment or a worn, damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result.

Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing hard or noisy shifts. In most cases, this condition will decline as the rings wear-in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears can generate a mild whine that may only be audible at extreme speeds.

Severe, obviously audible transmission noise is generally the result of a lubricant problem. Insufficient, improper, or contaminated lubricant can promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear breakage.

TRANSMISSION REMOVAL—AX 15

- (1) Shift transmission into first or third gear.
- (2) Raise vehicle on a hoist.
- (3) Disconnect necessary exhaust system components.
- (4) Support transmission with adjustable jack stand.
- (5) Disconnect rear cushion and mounting bracket from transmission, or transfer case (Fig. 1).
- (6) On XJ, remove rear crossmember. On YJ, remove skid plate (Fig. 1).
- (7) Disconnect transmission shift linkage, speedometer cable, transfer case vacuum lines and clutch hydraulic lines.
- (8) Lower transmission-transfer case assembly no more than 7.6 cm (3 in.) for access to shift lever.

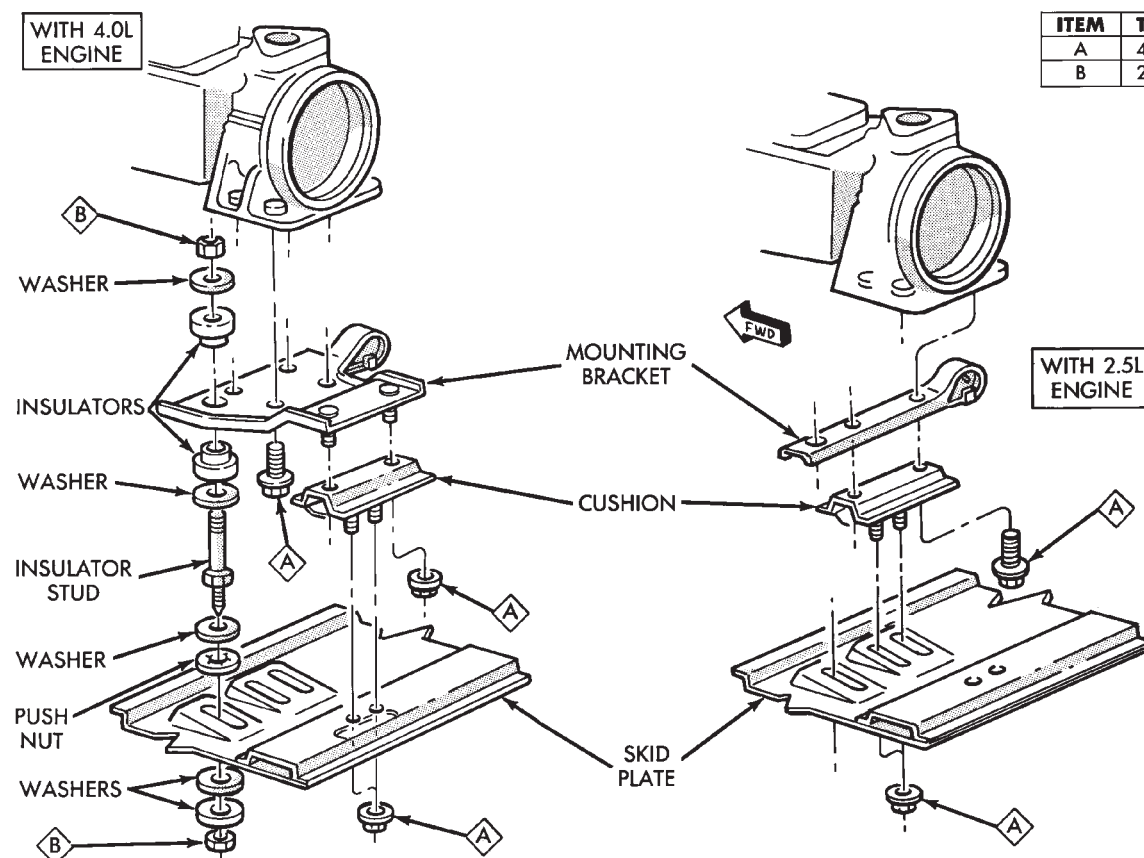


Fig. 1 Rear Mount Components (YJ Shown)

(9) Reach up and around transmission case and unseat shift lever dust boot from transmission shift tower (Fig. 2). Move boot upward on shift lever for access to lever retainer.

(10) Disengage shift lever as follows:

(a) Reach up and around transmission case and press shift lever retainer downward with your fingers.

(b) Turn retainer counterclockwise to release it.

(c) Lift lever and retainer out of shift tower (Fig. 2). **It is not necessary to remove shift lever from floorpan boot. Simply leave lever in place for later installation.**

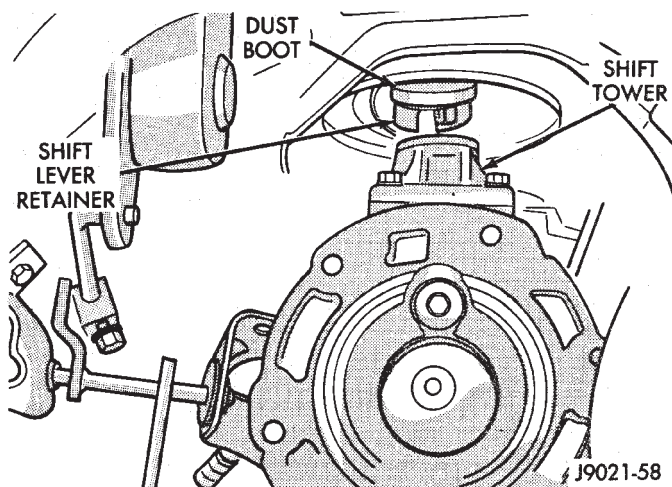


Fig. 2 Removing/Installing Shift Lever

(11) Mark front and rear propeller shafts for installation alignment (Fig. 3). Then remove both shafts.

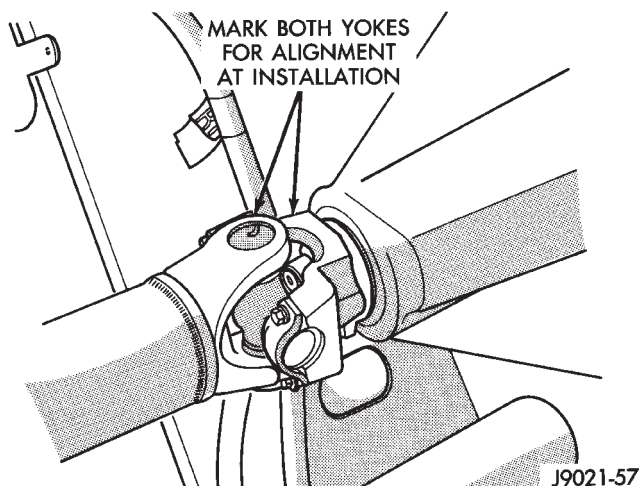


Fig. 3 Marking Propeller Shaft And Axle Yoke

(12) Remove crankshaft position/engine timing sensor (Fig. 4).

(13) Disconnect transmission and transfer case vent hoses.

(14) Remove slave cylinder from clutch housing.

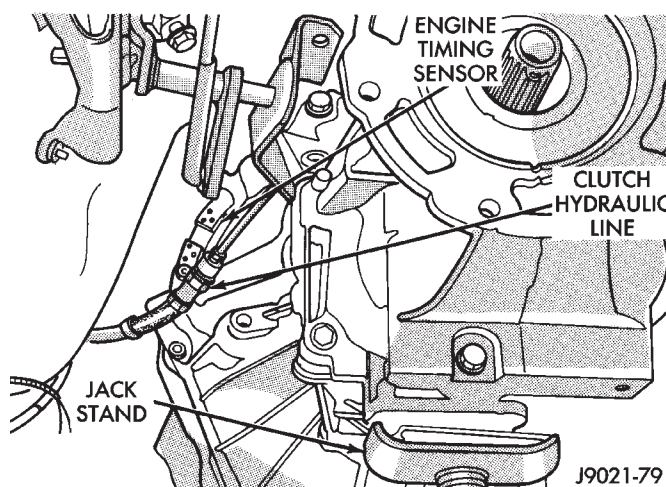


Fig. 4 Timing Sensor Location

(15) Support transmission-transfer case assembly with transmission jack. Secure assembly to jack with safety chains.

(16) Reposition adjustable jack stand under engine. Be sure to place wood block between jack and oil pan.

(17) Remove clutch housing brace rod.

(18) Remove clutch housing-to-engine bolts and remove transmission-transfer case assembly.

(19) Remove bolts attaching transmission to transfer case and separate components.

(20) Remove release bearing, fork and retainer clip.

(21) Remove clutch housing from transmission.

TRANSMISSION INSTALLATION—AX 15

(1) Install clutch housing on transmission. Tighten housing bolts to 37 N·m (27 ft-lbs) torque.

(2) Lubricate contact surfaces of release fork, lever and pivot ball stud. Then install bearing, fork and clip in clutch housing.

(3) Mount transmission on transmission jack. Secure transmission with safety chains.

(4) Lightly lubricate pilot bearing and transmission input shaft splines with Mopar high temperature grease.

(5) Align transmission input shaft and clutch disc splines and install transmission.

(6) Install and tighten clutch housing-to-engine bolts to 38 N·m (28 ft. lbs.) torque. **Be sure housing is properly seated on engine before tightening bolts.**

(7) Lower transmission no more than 7.6 cm (3 in.) for access to the shift tower.

(8) Reach up and around the transmission and insert shift lever in shift tower. Press lever retainer downward and turn it clockwise to lock it in place. Then install lever dust boot on shift tower.

(9) Connect engine timing sensor.

(10) Remove jack from under transmission and mount transfer case on jack.

(11) Align transfer case and transmission shafts and install transfer case. Tighten transfer case-to-transmission nuts/bolts to 35 N·m (26 ft. lbs.) torque.

(12) Move jack stand from under engine and reposition it under transmission. Then remove transmission jack.

(13) Connect transfer case vacuum hoses and linkage. Check and adjust linkage if necessary.

(14) Connect transmission and transfer case vent hoses and backup light switch wires.

(15) Install clutch sleeve cylinder.

(16) Connect vehicle speed sensor and wires.

(17) On XJ, install rear crossmember and attach cushion and bracket. Tighten crossmember-to-frame bolts to 41 N·m (30 ft. lbs.) torque. Tighten transmission-to-rear cushion and bracket bolts/nuts to 45 N·m (33 ft. lbs.) torque.

(18) On YJ, install rear cushion and bracket and skid plate. Tighten attaching bolts/nuts to indicated torque (Fig. 1).

(19) Align and install front/rear propeller shafts. Tighten shaft U-joint clamp bolts to 19 N·m (170 in. lbs.) torque.

(20) On XJ, install skid plate if removed. Tighten bolts to 42 N·m (31 ft. lbs.) torque. Tighten stud nuts to 17 N·m (150 in. lbs.) torque.

(21) Top off transmission and transfer lubricant levels.

(22) Remove supports and lower vehicle.

TRANSMISSION DISASSEMBLY AND OVERHAUL

ADAPTER/EXTENSION HOUSING REMOVAL

(1) Remove release bearing, fork, retainer clip and clutch housing from transmission. Also remove shift lever if not previously removed.

(2) On 2-wheel drive models, remove extension housing seal (Fig. 1).

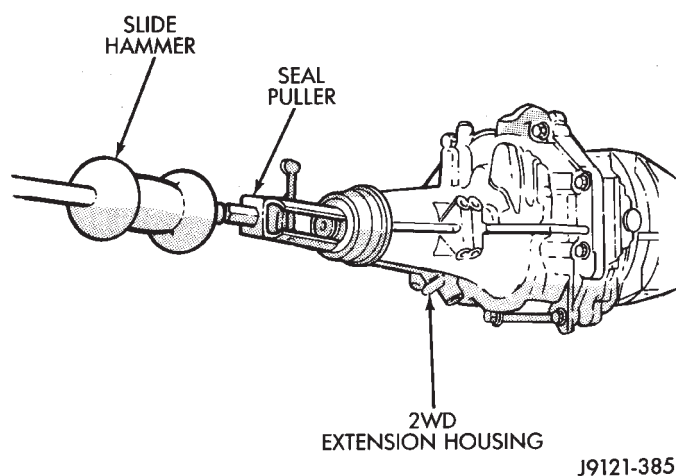


Fig. 1 Removing Extension Housing Seal

(3) Remove shift tower bolts and remove tower from adapter or extension housing (Fig. 2).

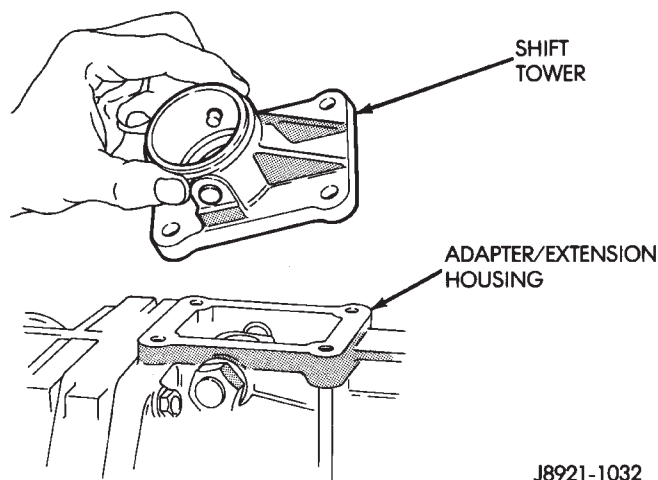


Fig. 2 Shift Tower Removal/Installation

(4) Remove gasket from shift tower (Fig. 3).

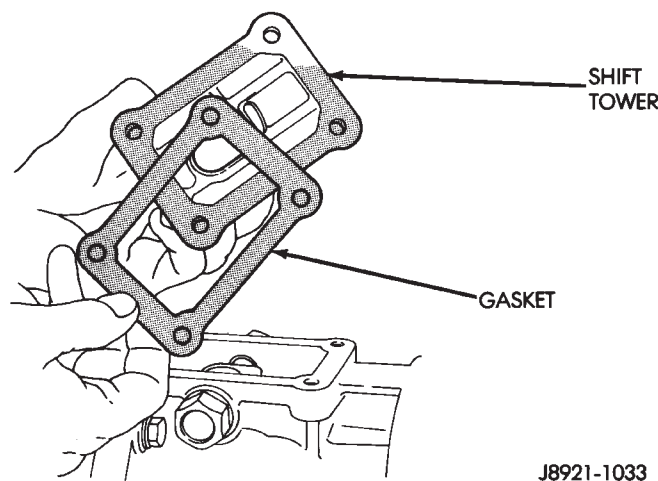


Fig. 3 Shift Tower Gasket Removal/Installation

(5) Remove shift arm retainer bolt (Fig. 4).

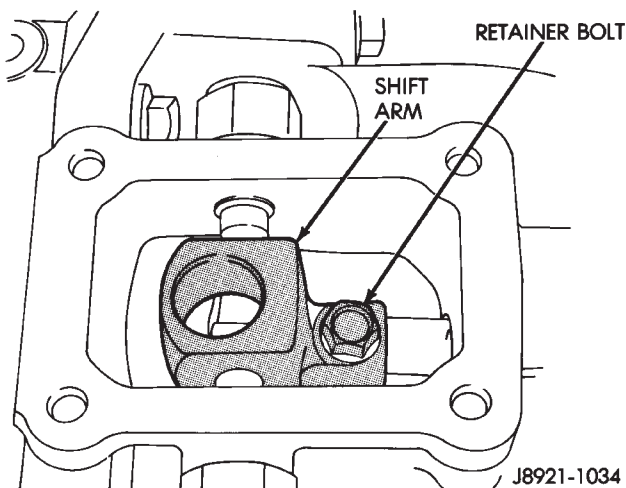


Fig. 4 Shift Arm Retainer Bolt Removal/Installation

(6) Loosen and remove restrictor pins (Fig. 5).

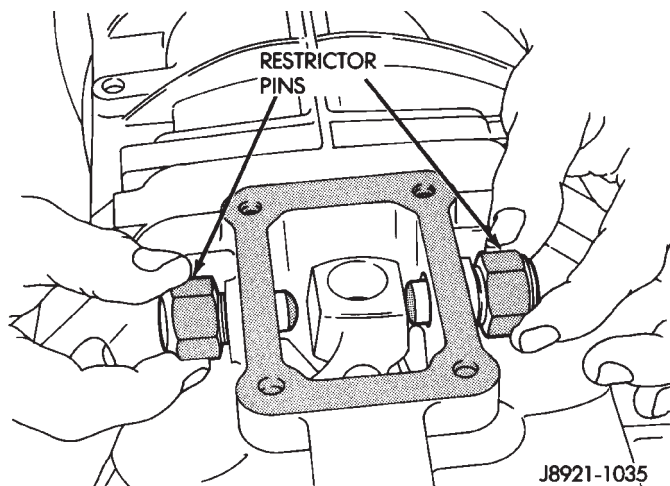


Fig. 5 Removing/Installing Restrictor Pins

(7) Remove shift arm shaft plug (Fig. 6).

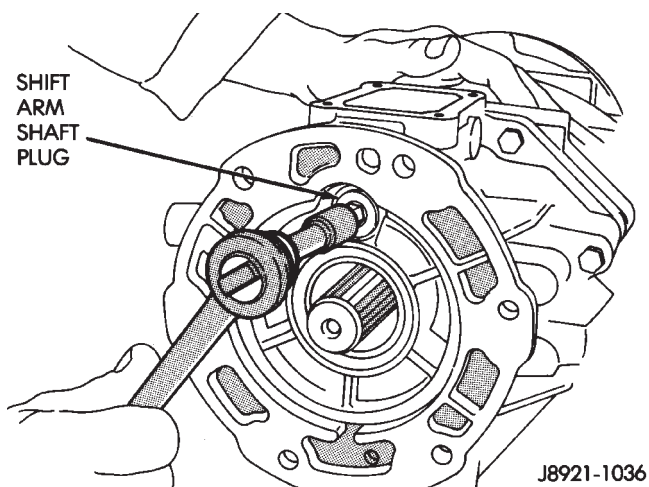


Fig. 6 Removing/Installing Shift Lever Shaft Plug

(8) Remove shift arm shaft with large magnet (Fig. 7).

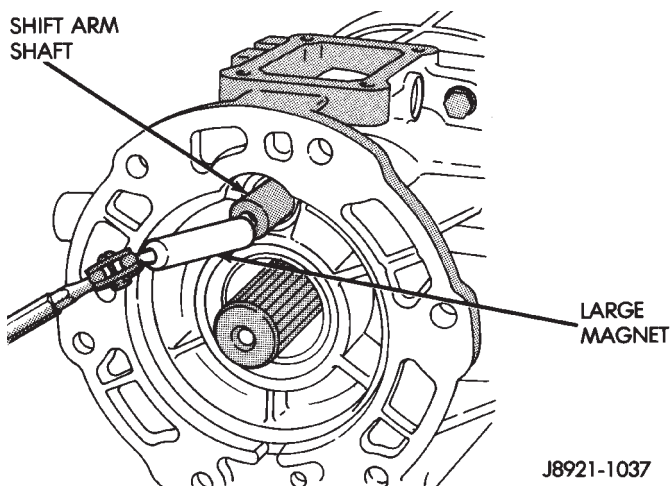


Fig. 7 Removing/Installing Shift Lever Shaft

(9) Remove shift arm (Fig. 8).

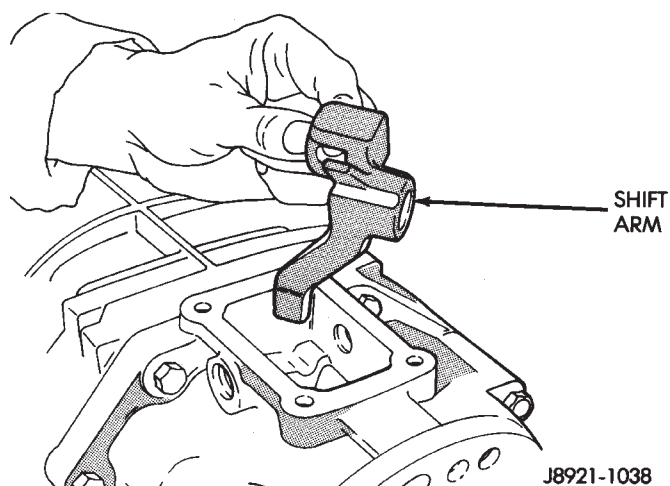


Fig. 8 Shift Arm Removal/Installation

(10) Remove plug for reverse shift head lock ball. Plug is at right side of adapter housing near backup light switch (Fig. 9).

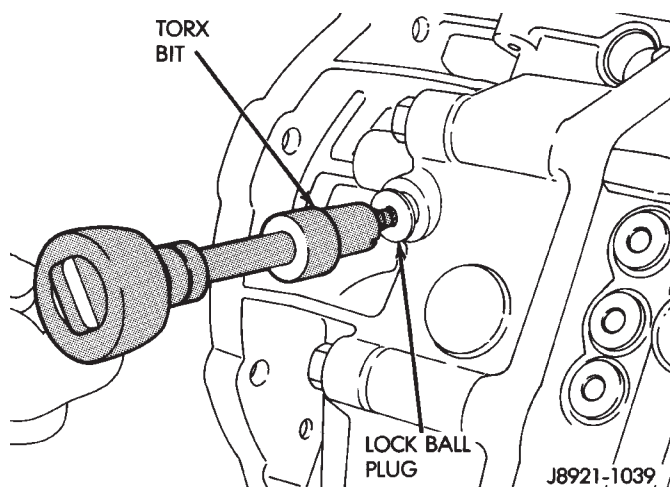


Fig. 9 Removing/Installing Lock Ball Plug

(11) Remove lock ball spring with pencil magnet (Fig. 10).

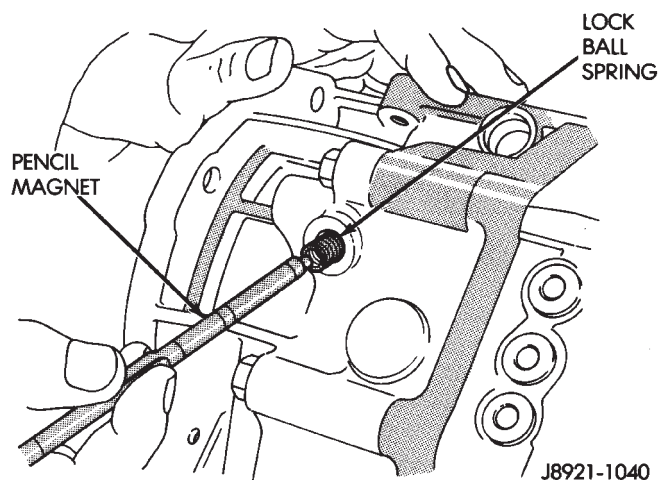


Fig. 10 Removing/Installing Lock Ball Spring

(12) Remove shift head lock ball with pencil magnet (Fig. 11).

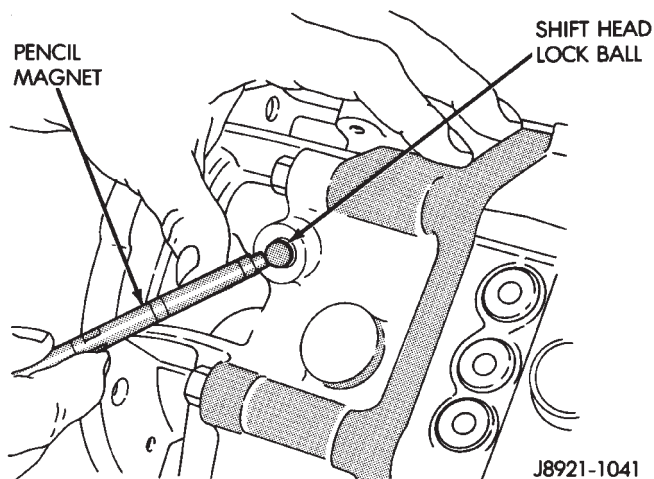


Fig. 11 Removing/Installing Shift Head Lock Ball

(13) Remove backup light switch from adapter/extension housing.

(14) On 2-wheel drive models, remove distance sensor, speedometer adapter and driven gear if not removed previously.

(15) Remove adapter/extension housing bolts (Fig. 12).

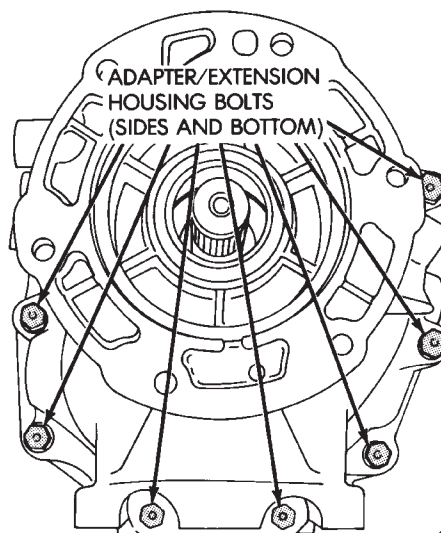
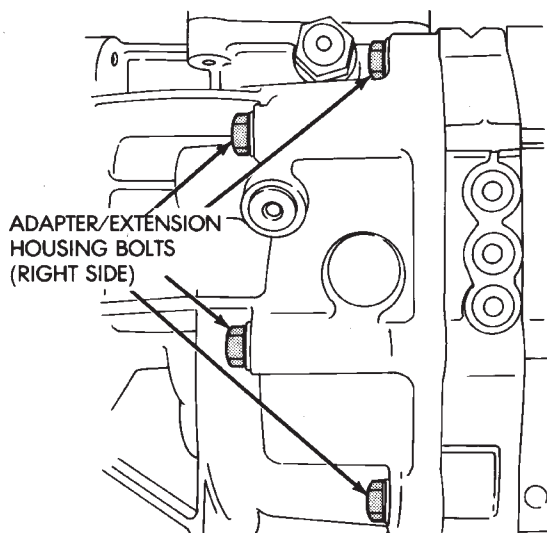
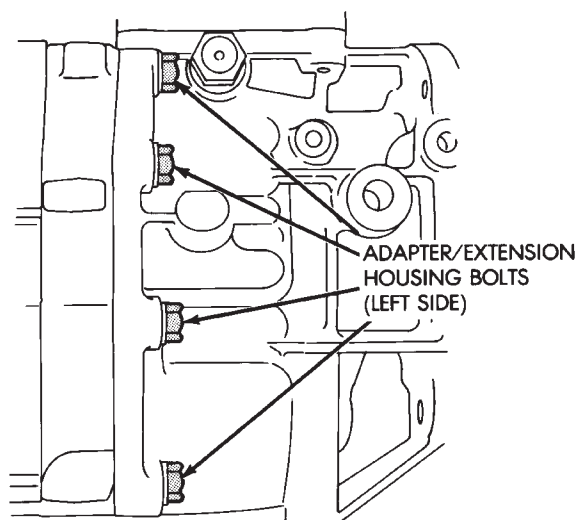


Fig. 12 Adapter Housing Bolt Locations

(16) Loosen adapter/extension housing with rubber mallet (Fig. 13).

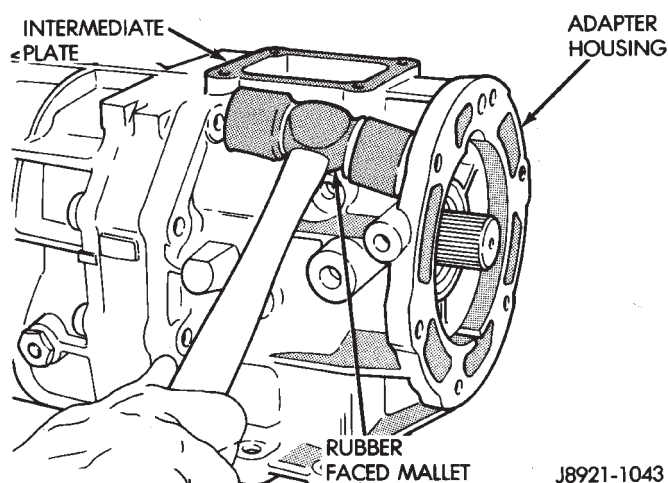


Fig. 13 Loosening Adapter Housing

(17) Remove housing after loosening it (Fig. 14)

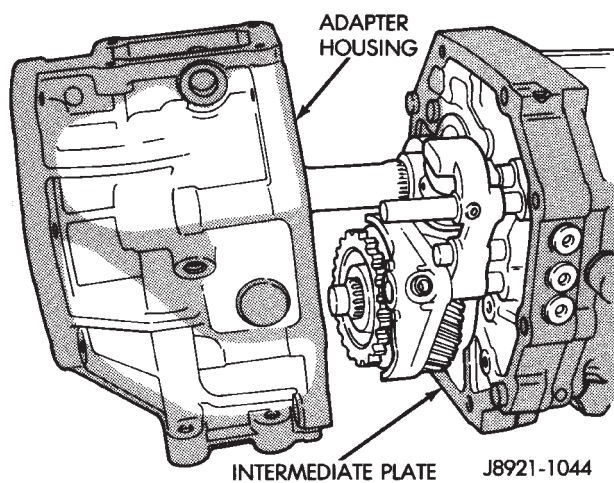


Fig. 14 Adapter Housing Removal

(18) Remove adapter housing oil seal with pry tool (Fig. 15).

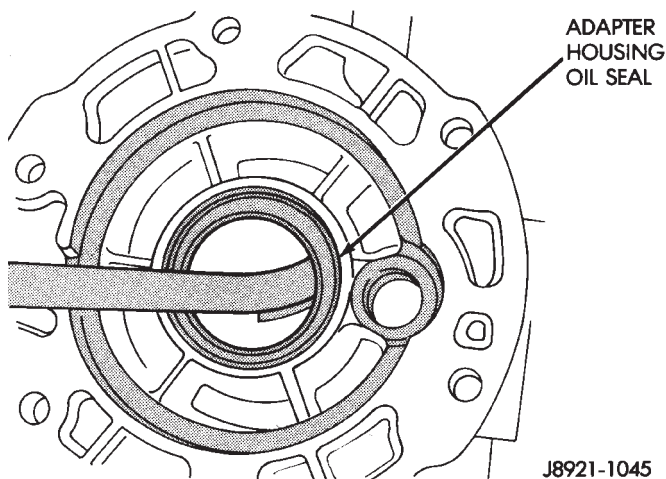


Fig. 15 Removing Adapter Housing Seal

GEAR CASE REMOVAL

(1) Remove bearing retainer bolts and remove retainer (Fig. 16).

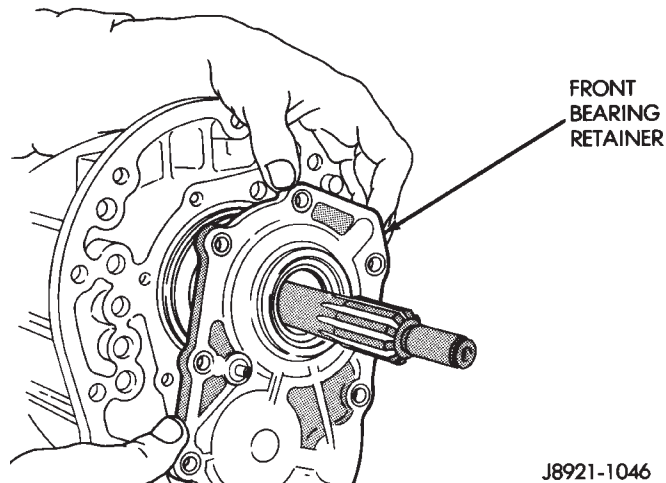


Fig. 16 Front Bearing Retainer Removal

(2) Remove retainer oil seal with pry tool (Fig. 17).

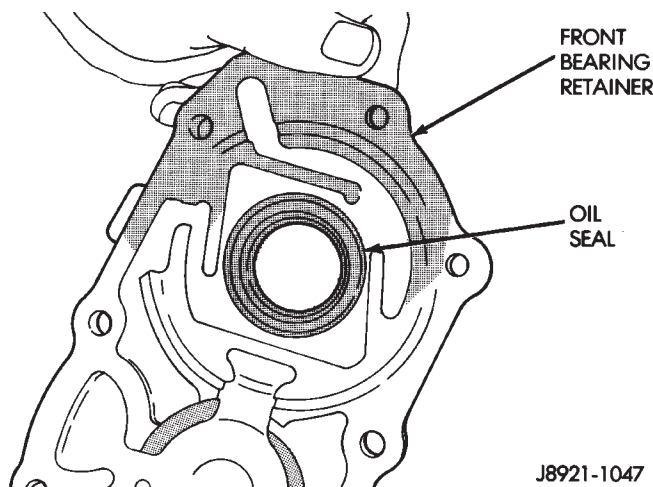


Fig. 17 Front Bearing Retainer Seal Location

(3) Remove input shaft bearing snap ring (Fig. 18).

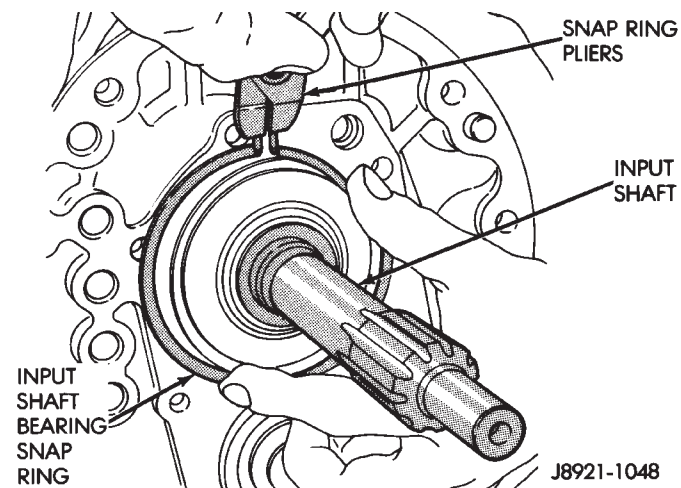


Fig. 18 Removing Input Shaft Bearing Snap Ring

(4) Remove cluster gear front bearing snap ring (Fig. 19).

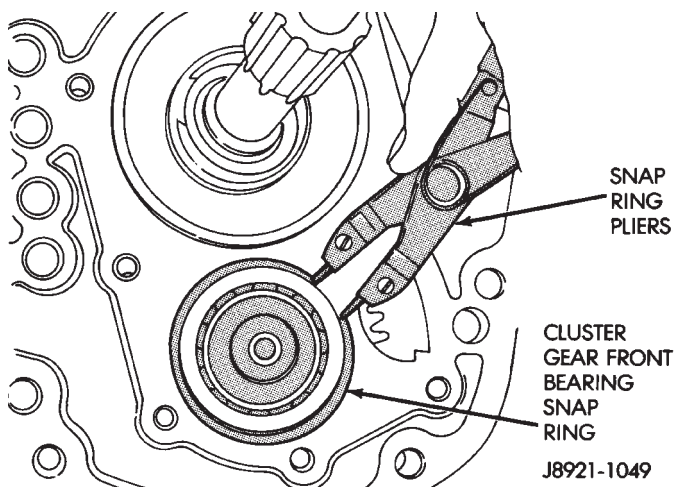


Fig. 19 Removing Cluster Gear Front Bearing Snap Ring

(5) Loosen gear case by tapping it away from intermediate plate with rubber mallet (Fig. 20).

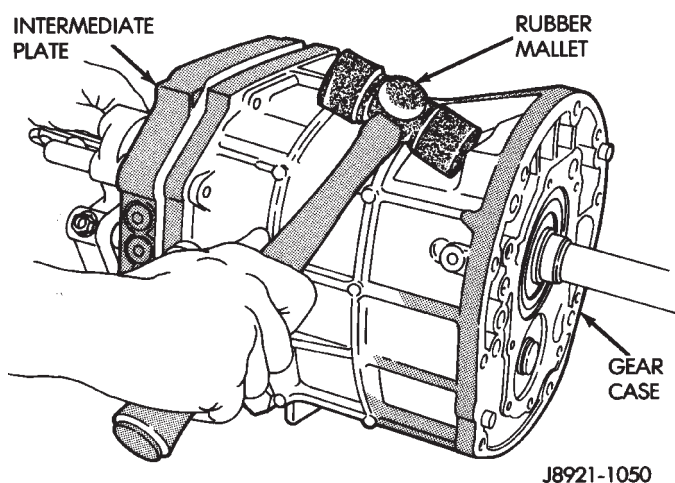


Fig. 20 Loosening Gear Case

(6) Remove gear case from geartrain and intermediate plate (Fig. 21).

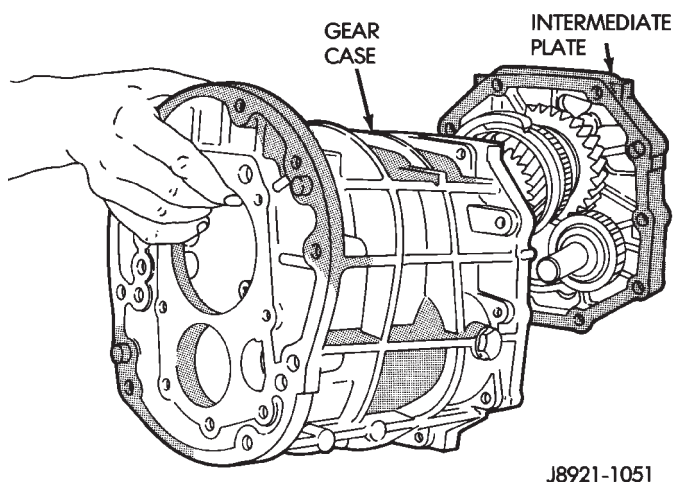


Fig. 21 Gear Case Removal

(7) On 2-wheel drive models, remove speedometer gear snap ring and remove speedometer gear and spacer from output shaft.

FIFTH GEAR AND SYNCHRO ASSEMBLY REMOVAL

(1) Remove three lock ball plugs from intermediate plate (Fig. 22).

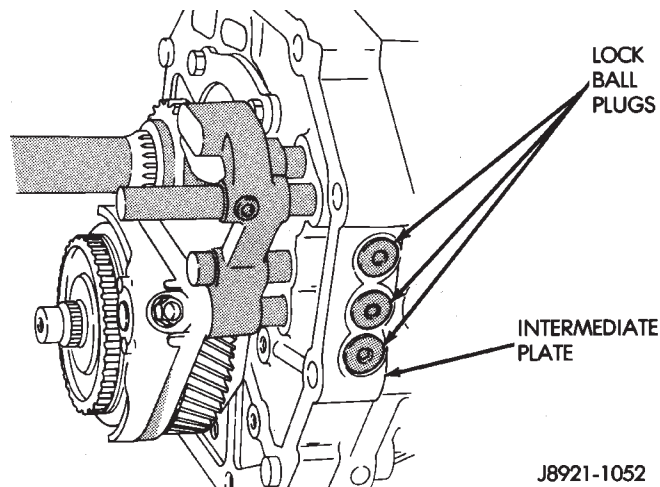


Fig. 22 Lock Ball Plug Locations

(2) Remove three lock ball springs and lock balls from intermediate plate with pencil magnet (Fig. 23).

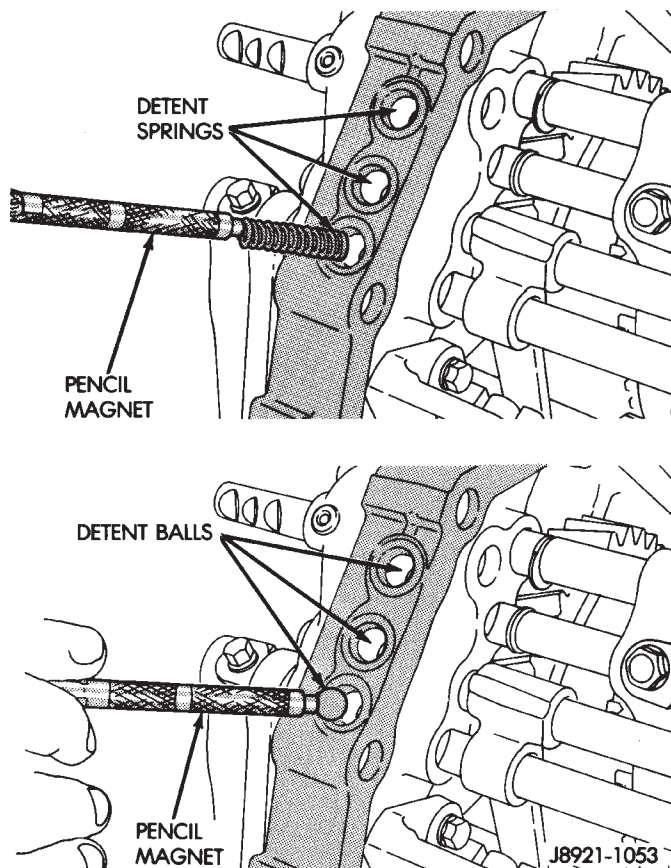


Fig. 23 Removing/Installing Lock Ball And Spring

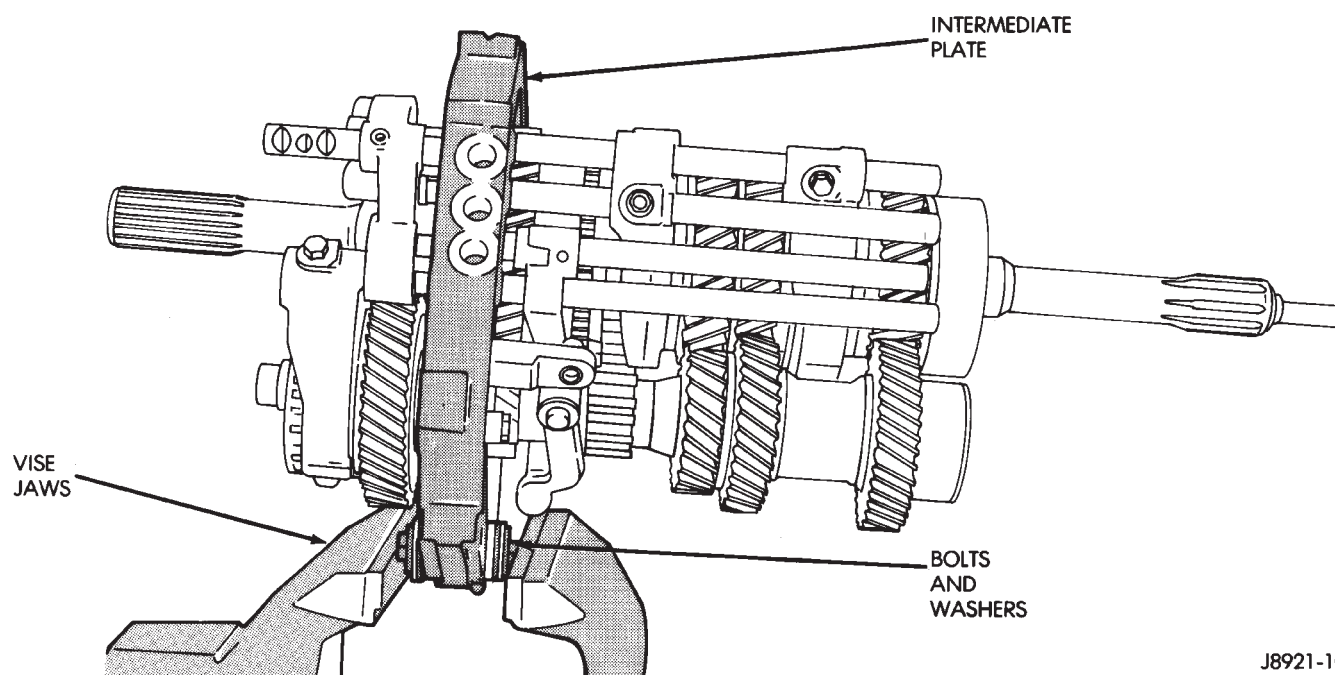


Fig. 24 Mounting Intermediate Plate And Geartrain In Vise

(3) Mount intermediate plate and geartrain assembly in vise as follows:

(a) Insert two spare bolts in one bottom bolt hole in intermediate plate. Insert bolts from opposite sides of plates (Fig. 24).

(b) Install enough flat washers under each bolt head to prevent bolts from touching (Fig. 24).

(c) Tape bolts and washers in place and mount intermediate plate in vise (Fig. 24).

(d) Clamp vise jaws securely against bolt heads (Fig. 24). **Do not clamp vise jaws on intermediate plate. Clamp only on bolt heads.**

(4) Remove fifth gear snap ring (Fig. 25). Retain snap ring for assembly reference. It is a select fit component.

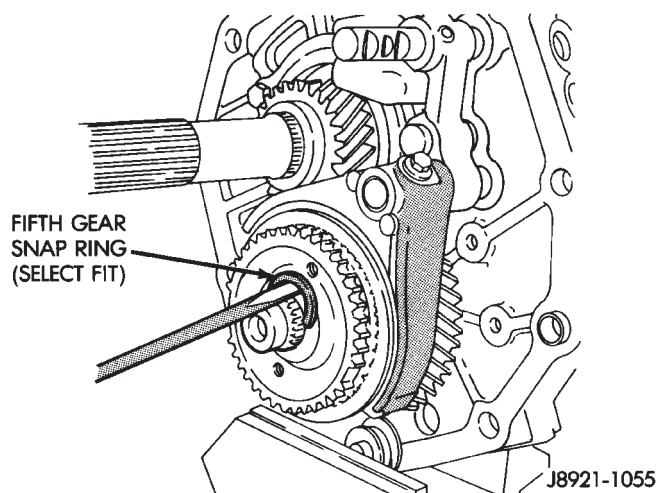


Fig. 25 Fifth Gear Snap Ring Removal

(5) Remove E-ring that secures reverse shift arm to fork (Fig. 26).

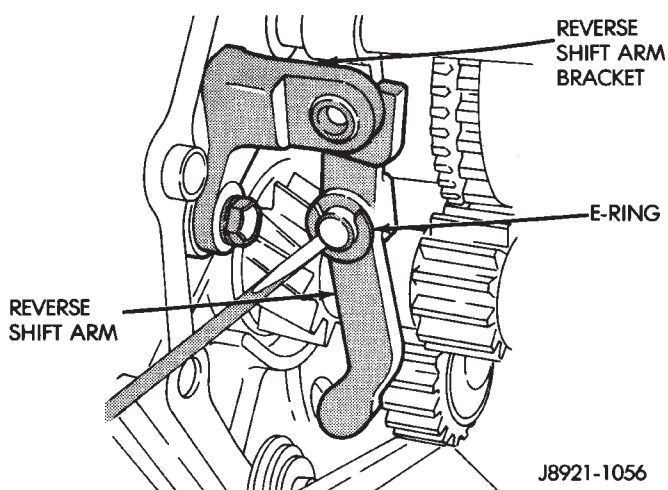


Fig. 26 Removing Reverse Shift Arm E-Ring

(6) Remove bolts attaching reverse shift arm bracket to intermediate plate. Then remove bracket (Fig. 27).

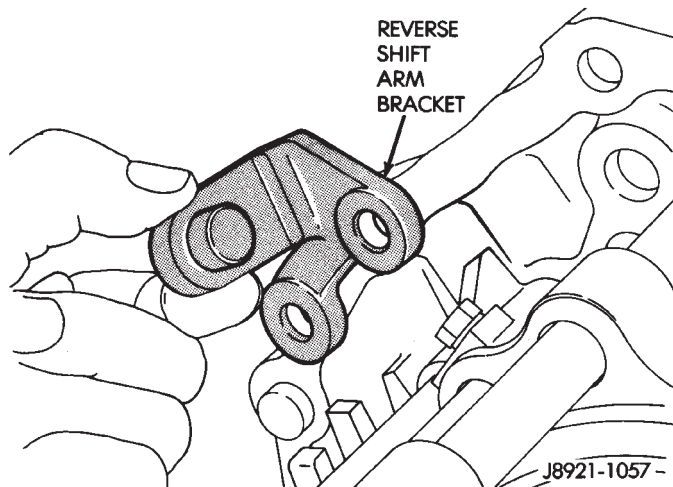


Fig. 27 Removing Reverse Shift Arm Bracket

(7) Remove reverse shift arm and shoe (Fig. 28).

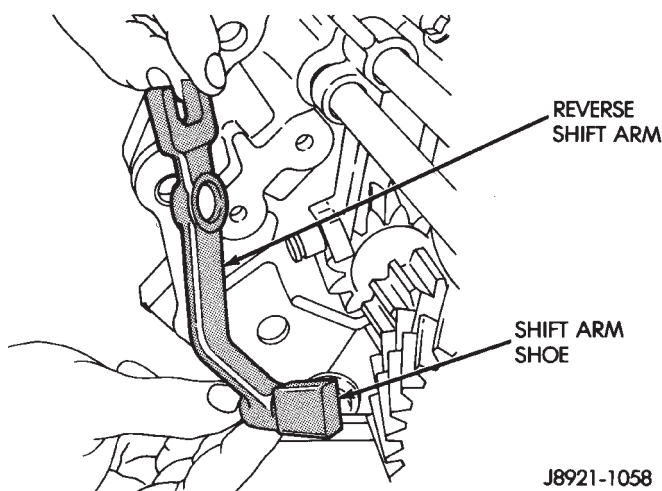


Fig. 28 Removing Reverse Shift Arm And Shoe

(8) Remove fifth gear shift fork set screw (Fig. 29).
 (9) Move fifth gear shift rail forward until it clears shift fork.

(10) Remove fifth gear shift fork from synchro sleeve (Fig. 30).

(11) Remove reverse shift rail and reverse shift head as assembly (Fig. 31).

(12) Measure thrust clearance between counter fifth gear and thrust ring with feeler gauge. Clearance should be 0.10 - 0.40 mm (0.003 - 0.019 in.). If clearance exceeds limits, gear and/or ring will have to be replaced.

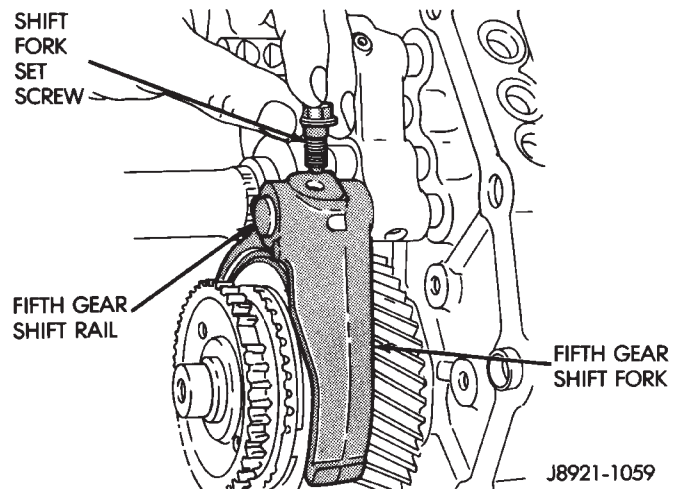


Fig. 29 Removing Fifth Gear Fork Set Screw

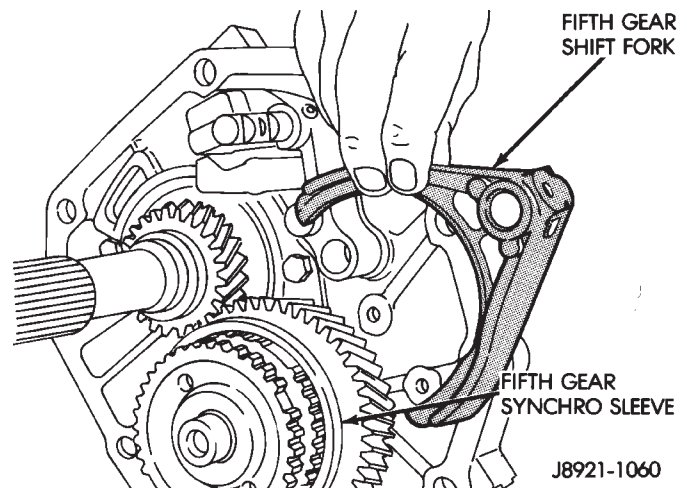


Fig. 30 Removing Fifth Gear Shift Fork

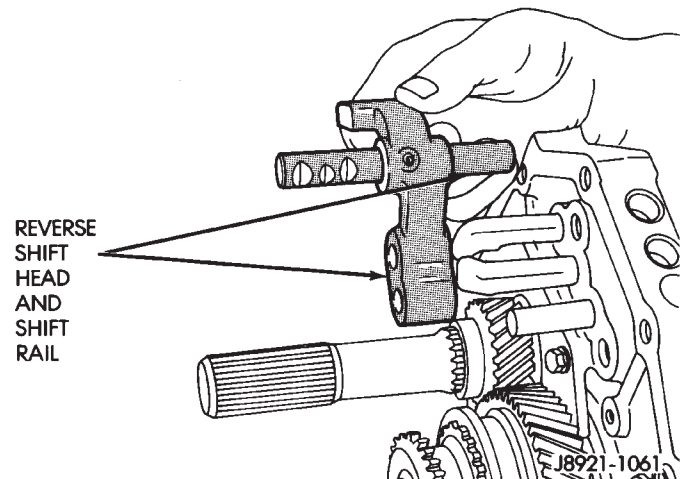


Fig. 31 Removing Reverse Shift Head And Rail

(13) Loosen fifth spline gear with standard two-jaw puller (Fig. 32). Position puller jaws **behind fifth counter gear** as shown.

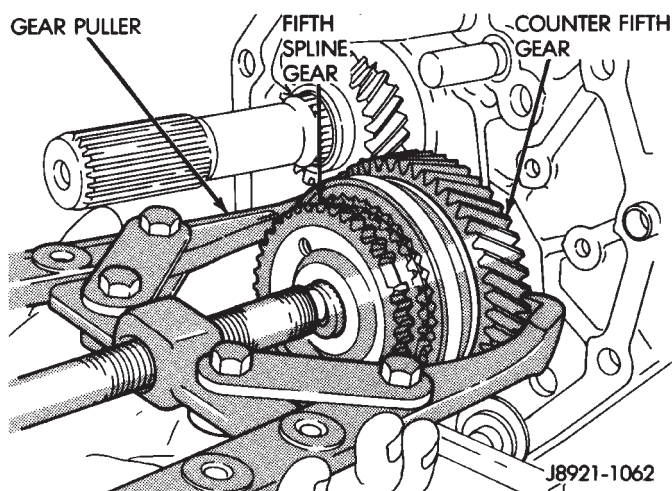


Fig. 32 Loosening Fifth Spline Gear

(14) Remove fifth spline gear (Fig. 33).

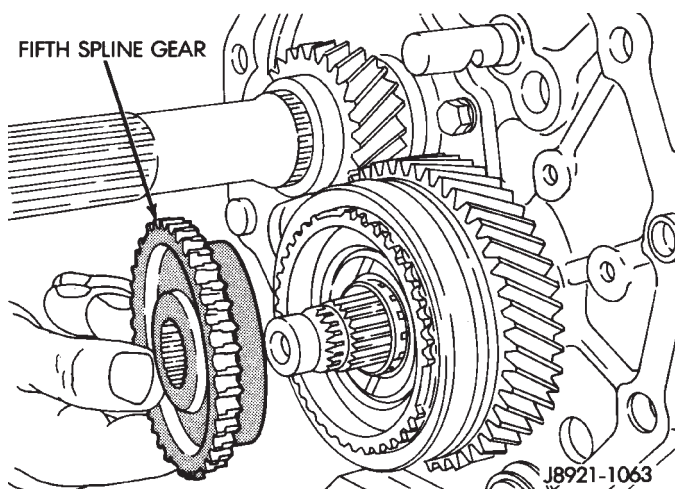


Fig. 33 Removing Fifth Spline Gear

(15) Remove fifth gear synchro ring (Fig. 34).

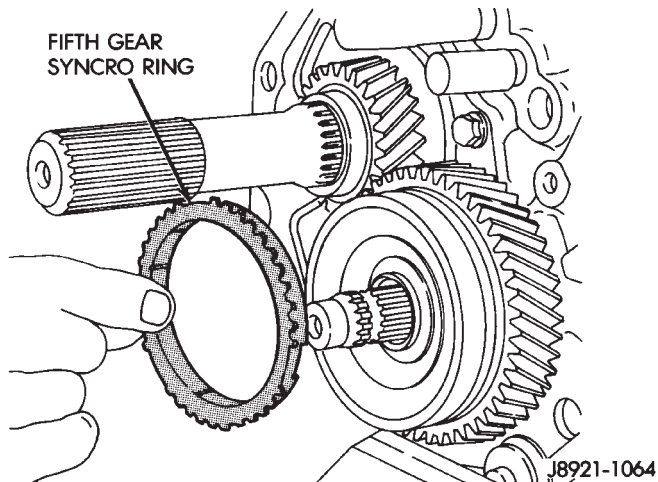


Fig. 34 Removing Fifth Gear Synchro Ring

(16) Remove fifth gear synchro and sleeve assembly (Fig. 35).

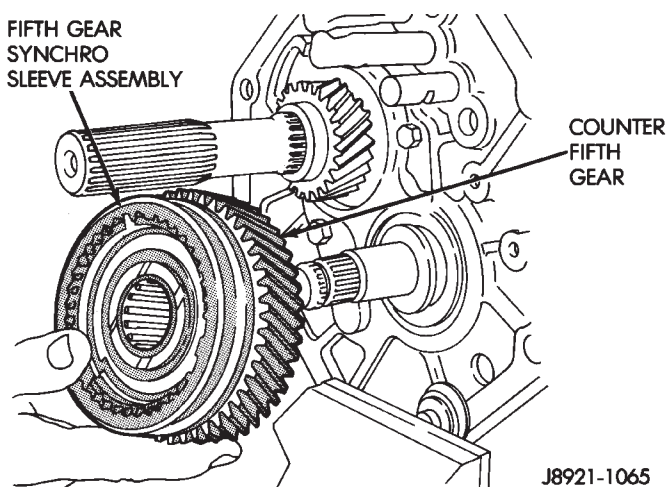


Fig. 35 Removing Counter Fifth Gear And Synchro Assembly

(17) Remove counter fifth gear thrust ring (Fig. 36).

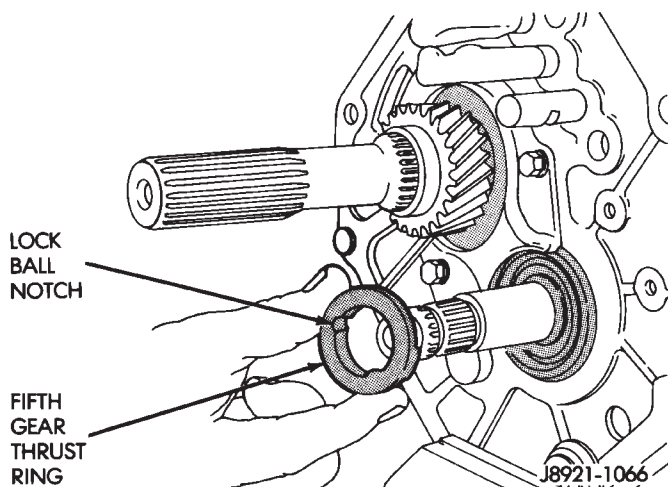


Fig. 36 Removing Fifth Gear Thrust Ring

(18) Remove thrust ring lock ball with pencil magnet (Fig. 37).

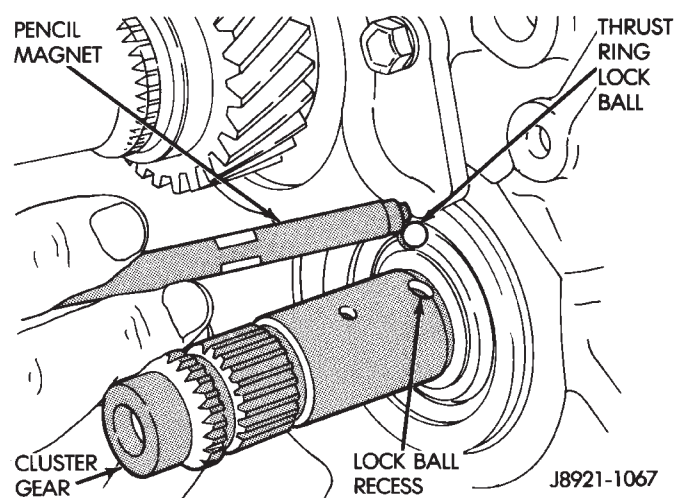


Fig. 37 Removing Thrust Ring Lock Ball

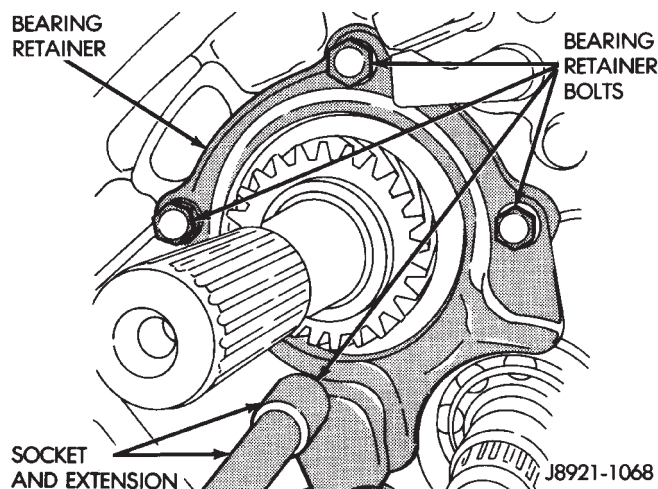


Fig. 38 Removing Output Shaft Rear Bearing Retainer Bolts

(19) Remove bolts attaching output shaft rear bearing retainer to intermediate plate (Fig. 38).

(20) Remove rear bearing retainer (Fig. 39).

(21) Remove reverse gear and shaft (Fig. 40).

SHIFT RAIL AND FORK REMOVAL

There are a total of five shift rails in the AX 15 transmission. The 1-2, 3-4, fifth gear and front reverse shift rails are shown in Figure 41.

Two shift rails are used for reverse gear range. The front reverse rail is at the forward side of the intermediate plate (Fig. 41). The short rear reverse rail and reverse shift head are at the rear side of the intermediate plate.

It is not necessary to remove the shift rails if they do not require service during overhaul.

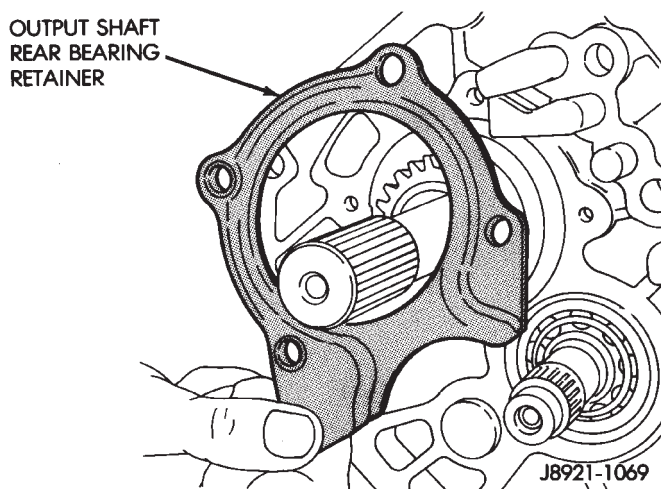


Fig. 39 Removing Output Shaft Rear Bearing Retainer

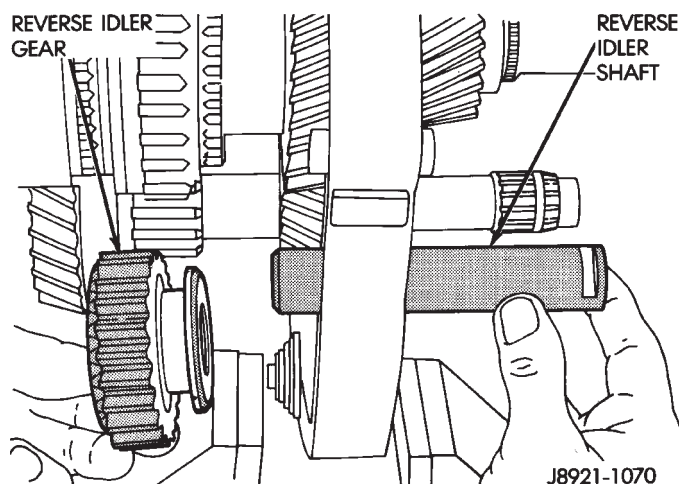


Fig. 40 Removing Reverse Idler Gear And Shaft

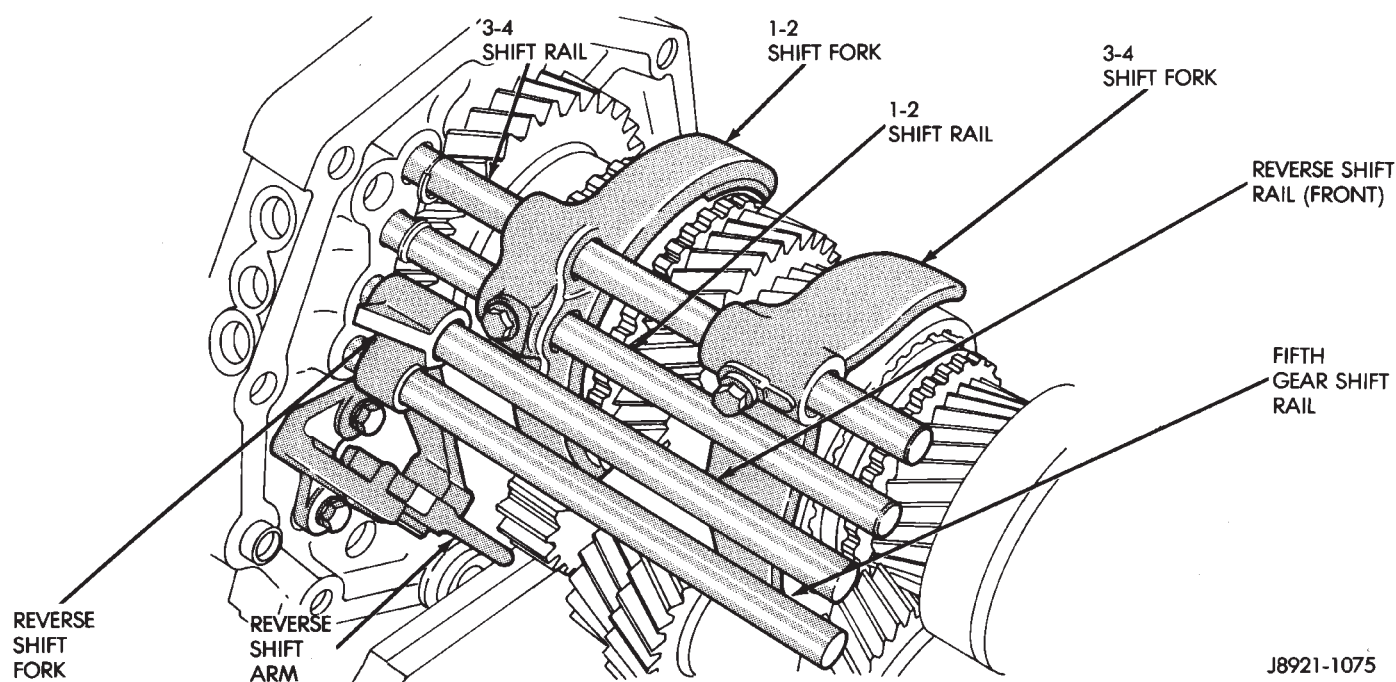


Fig. 41 Shift Rail Identification

Only the shift forks need be removed for access to the transmission shafts and gears.

(1) Remove fifth gear shift rail (Fig. 41). Catch lock ball in your hand as rail comes out of intermediate plate.

(2) Remove 1-2 and 3-4 shift rail C-rings with two screwdrivers of equal size and length (Fig. 42).

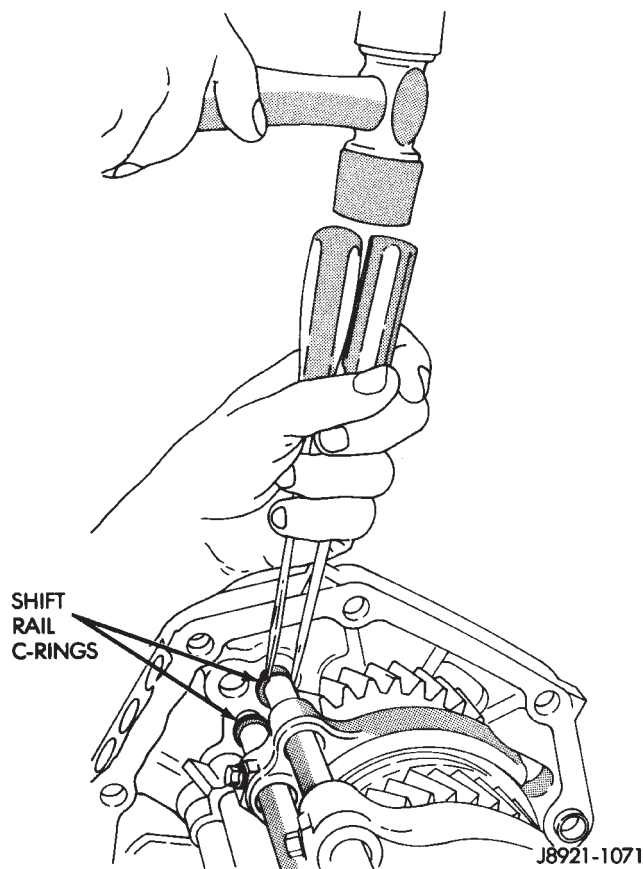


Fig. 42 Removing Shift Rail C-Rings

(3) Remove shift fork set screws (Fig. 43).

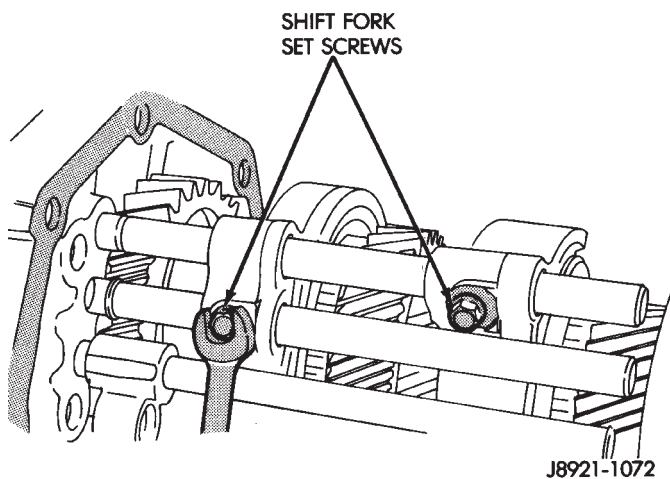


Fig. 43 Removing Shift Fork Set Screws

(4) Remove 3-4 shift rail from shift fork and intermediate plate (Fig. 44).

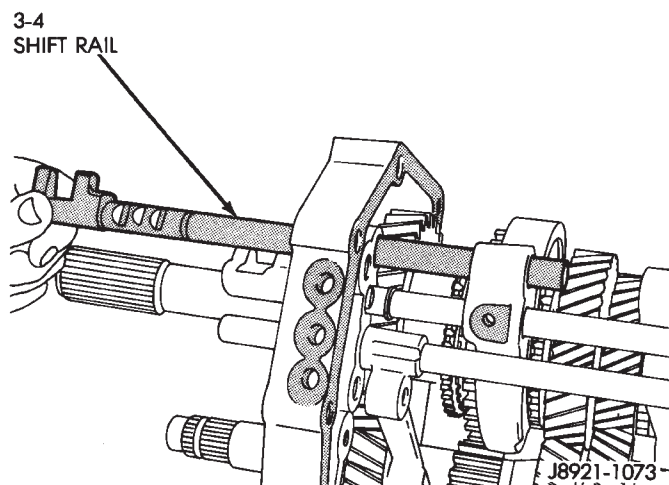


Fig. 44 Removing 3-4 Shift Rail

(5) Remove 3-4 shift rail interlock plug from intermediate plate with magnet (Fig. 45).

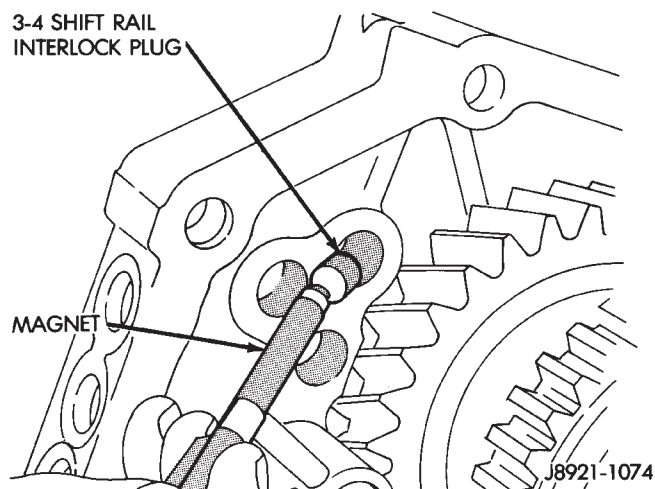


Fig. 45 Removing 3-4 Shift Rail Interlock Plug

(6) Remove 1-2 shift rail from shift fork and intermediate plate (Fig. 46).

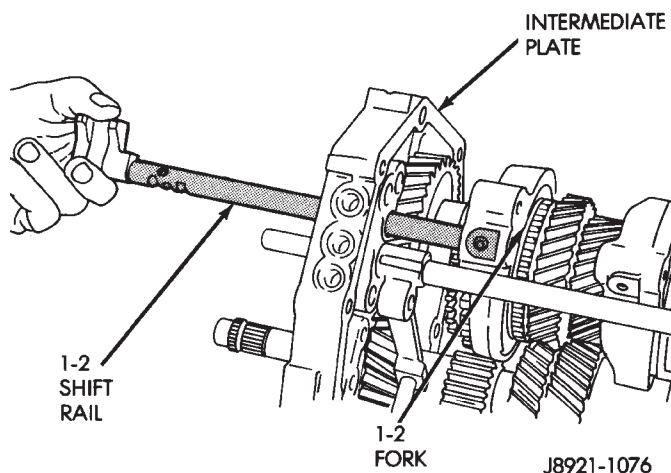


Fig. 46 Removing 1-2 Shift Rail

(7) Remove 1-2 shift rail interlock pin from shift rail (Fig. 47).

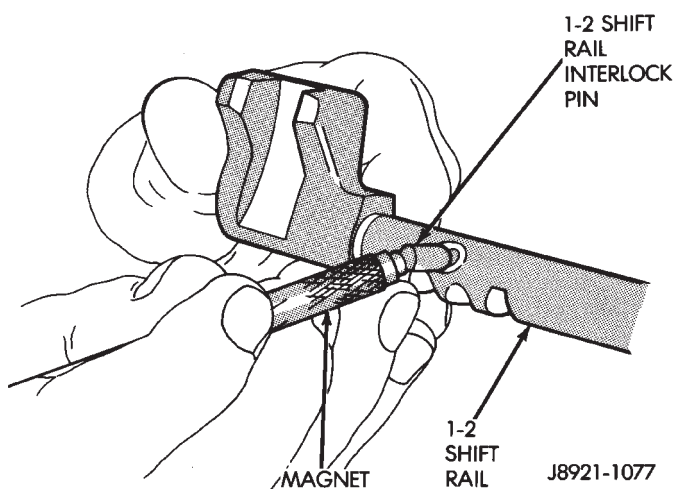


Fig. 47 Removing 1-2 Shift Rail Interlock Pin

(8) Remove 1-2 shift rail interlock plug from intermediate plate (Fig. 48).

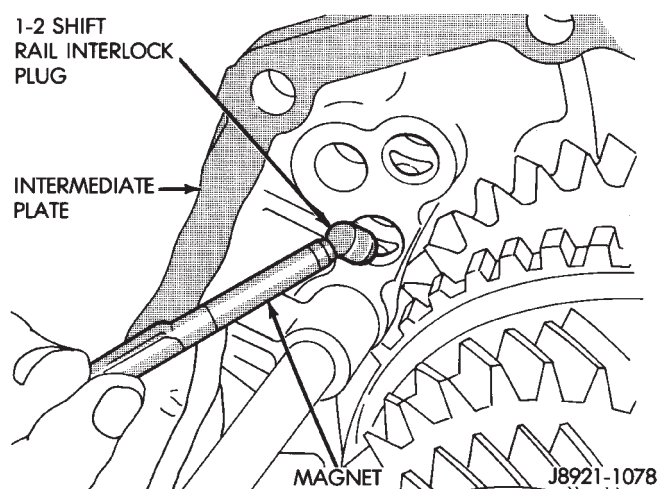


Fig. 48 Removing 1-2 Shift Rail Interlock Plug

(9) Lift reverse shift fork upward and remove fifth gear shift rail lock ball (Fig. 49).

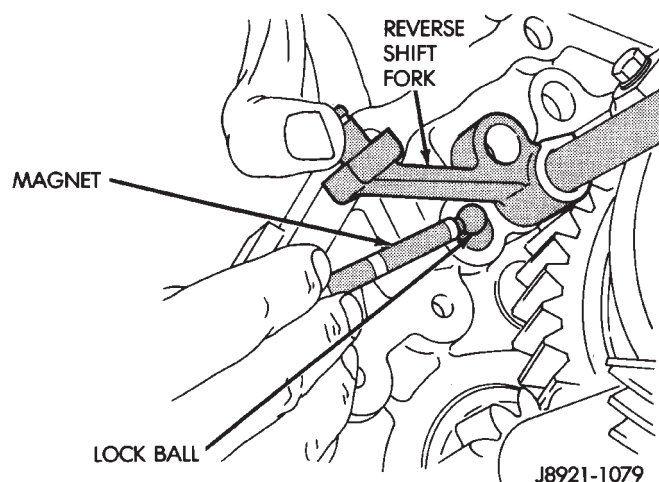


Fig. 49 Removing Fifth Gear Shift Rail Lock Ball

(10) Remove 3-4 shift fork (Fig. 50).

(11) Remove 1-2 shift fork (Fig. 50).

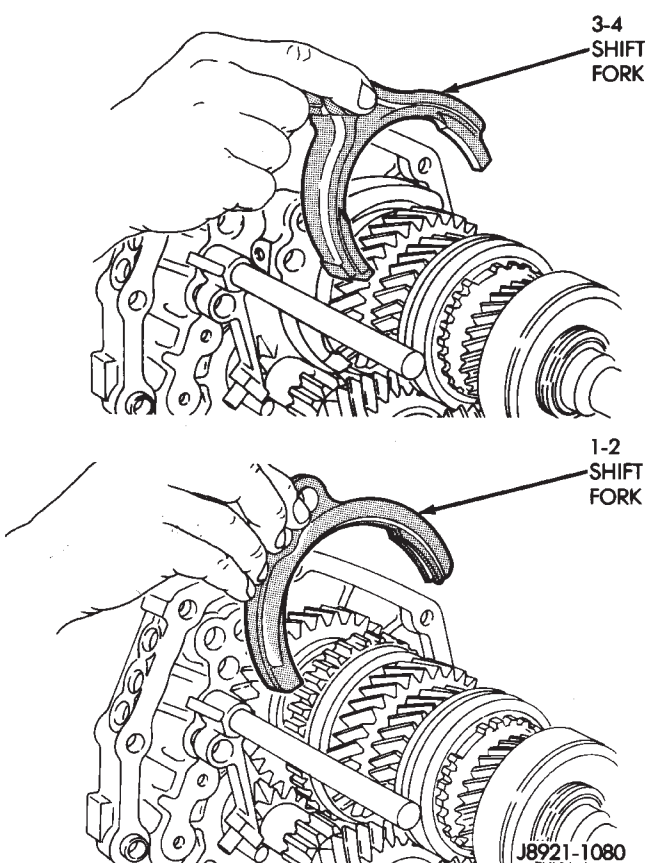


Fig. 50 Shift Fork Removal

(12) Remove reverse shift rail C-ring with two equal length and size screwdrivers (Fig. 51).

(13) Remove reverse shift rail and fork (Fig. 52).

(14) Remove interlock pin from reverse shift rail (Fig. 53).

(15) Position shift rails, shift forks, lock balls, interlock plugs and interlock pins on the workbench in order of removal. This will help in identifying components during inspection and assembly.

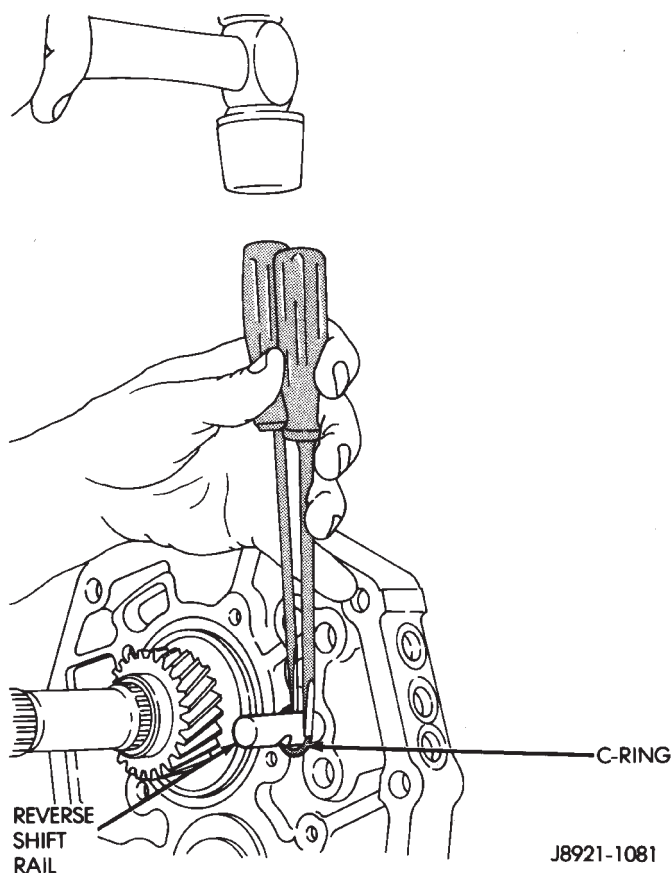


Fig. 51 Removing Reverse Shift Rail C-Ring

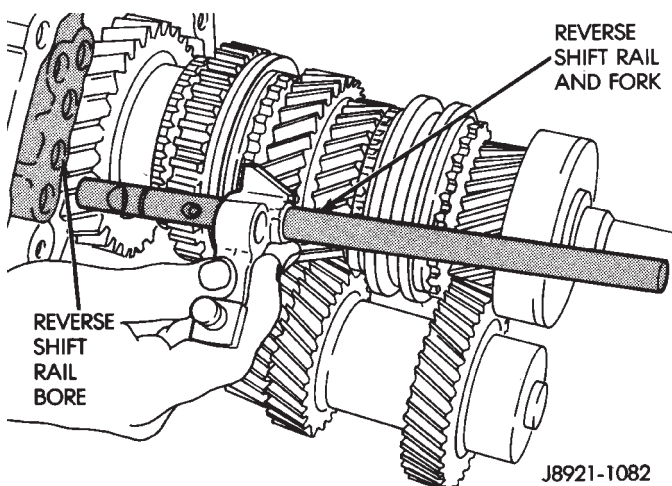


Fig. 52 Removing Reverse Shift Rail And Fork

OUTPUT SHAFT AND CLUSTER GEAR REMOVAL

- (1) Remove output shaft rear bearing snap ring (Fig. 54).
- (2) Remove cluster gear rear bearing snap ring (Fig. 54).
- (3) Tap end of output shaft with mallet to unseat and start rear bearing out of intermediate plate (Fig. 55).

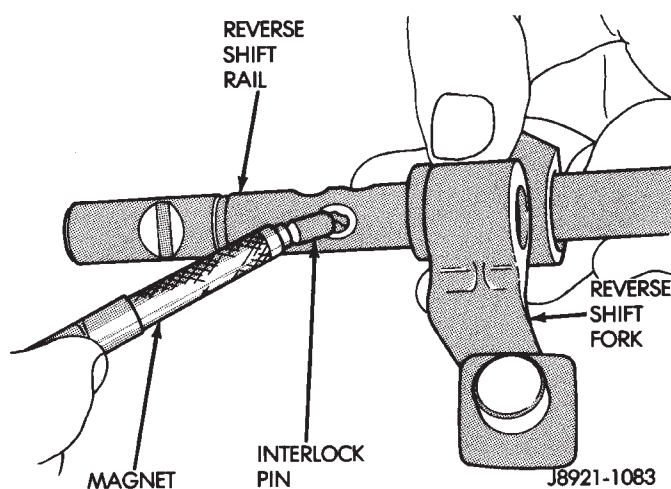


Fig. 53 Removing Reverse Shift Rail Interlock Pin

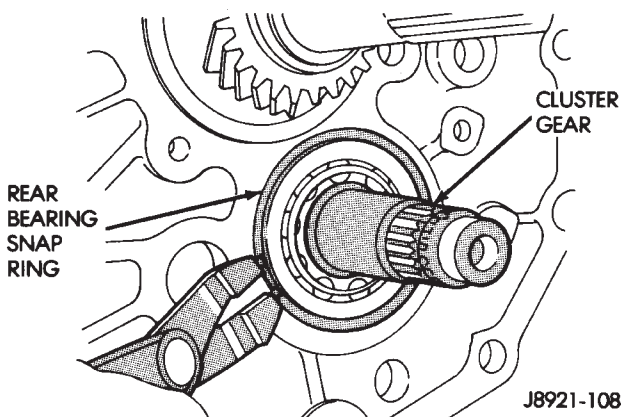
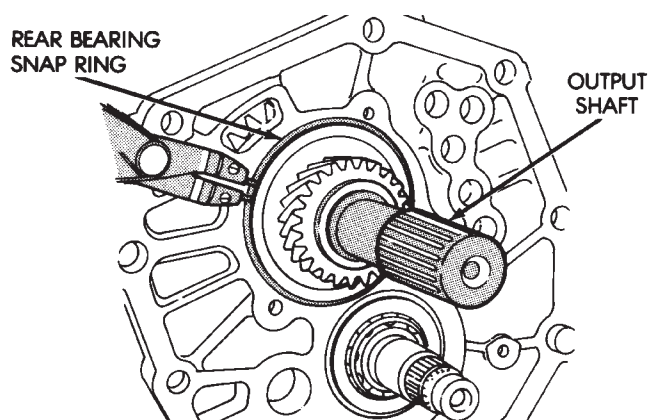


Fig. 54 Removing Bearing Snap Rings

- (4) Remove output shaft by rocking it lightly until rear bearing comes out of intermediate plate (Fig. 56).
- (5) Remove cluster gear by pulling it straight out of rear bearing (Fig. 57).
- (6) Remove cluster gear rear bearing from intermediate plate (Fig. 58).
- (7) Remove input shaft from output shaft (Fig. 59).
- (8) Remove output shaft pilot bearing from input shaft (Fig. 60).
- (9) Remove synchro ring from input shaft (Fig. 61).

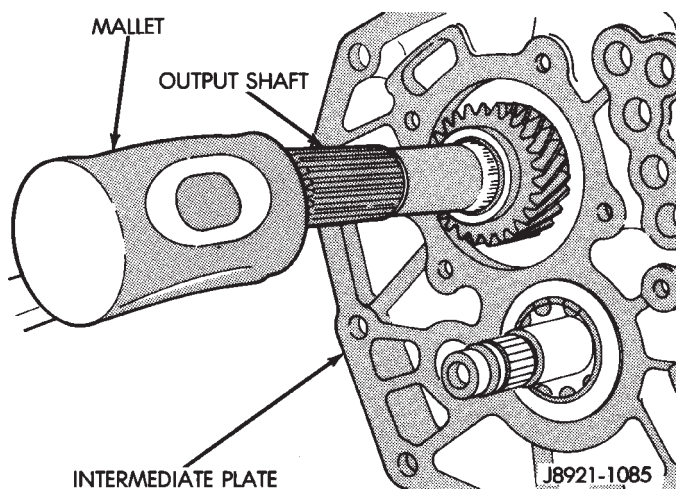


Fig. 55 Unseating Output Shaft Rear Bearing

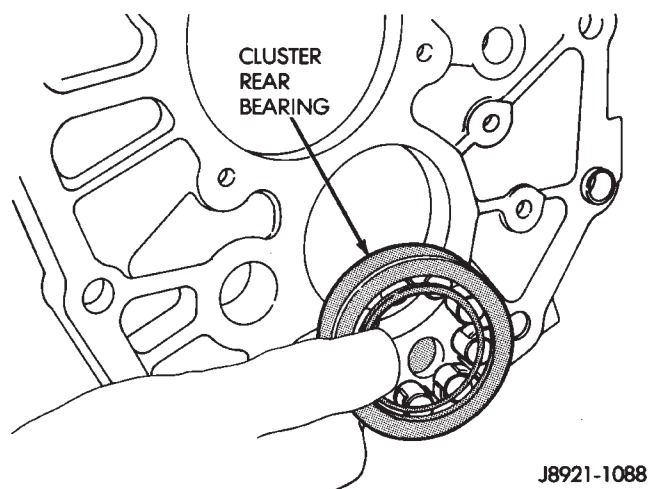


Fig. 58 Removing Cluster Gear Rear Bearing

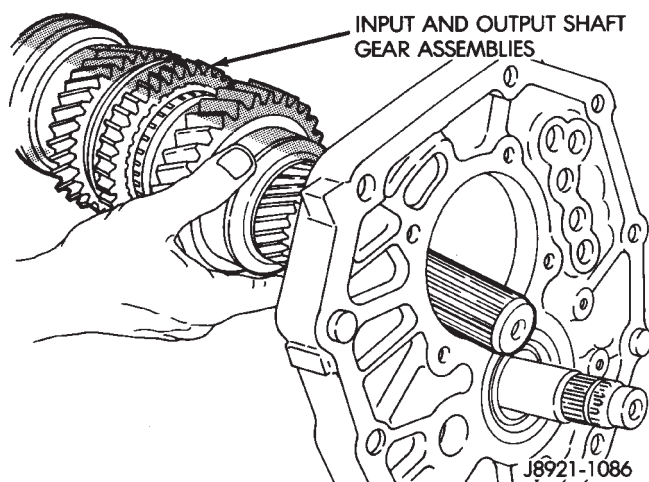


Fig. 56 Input/Output Shaft Assembly Removal

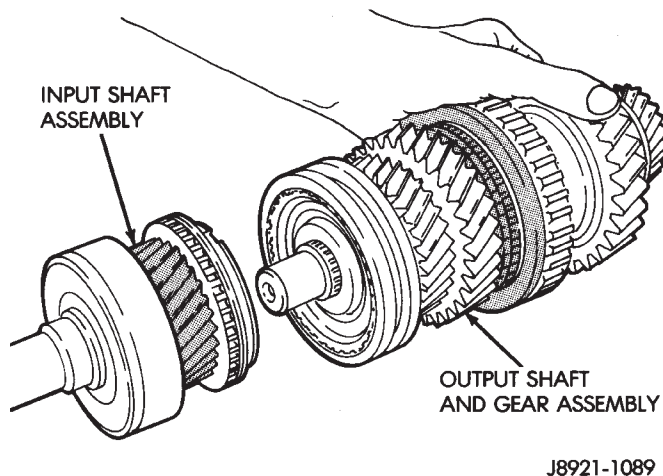


Fig. 59 Input Shaft Removal

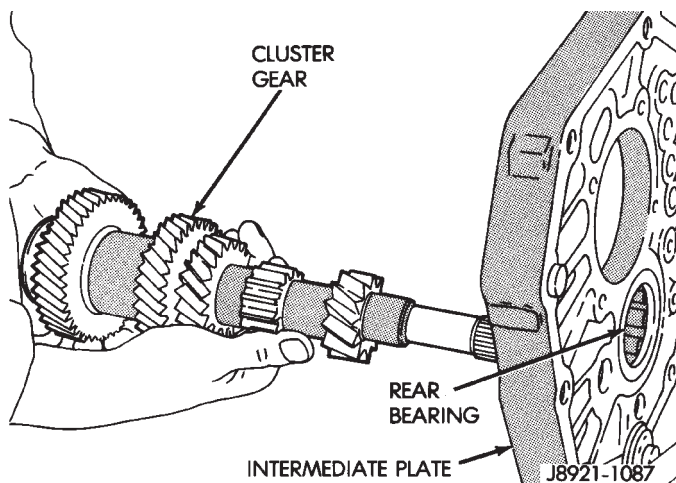


Fig. 57 Cluster Gear Removal

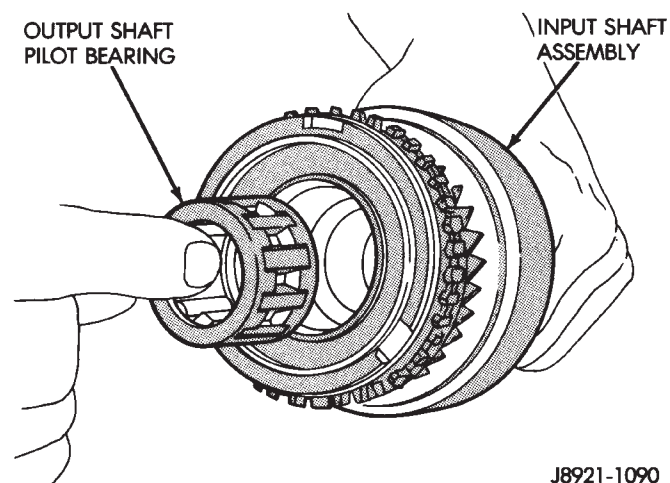


Fig. 60 Removing Input Shaft Pilot Bearing

(10) Remove bearing snap ring and press bearing off input shaft (Fig. 61).

OUTPUT SHAFT DISASSEMBLY

(1) Measure thrust clearance of output shaft first, second and third gears with feeler gauge (Fig. 62).

- First gear clearance should be 0.10 - 0.40 mm (0.003 - 0.0197 in).
- Second—third gear clearance should be 0.10 - 0.30 mm (0.003 - 0.0118 in.).

(2) If first gear thrust clearance is incorrect, replace gear and thrust washer. **If second or third gear clearance is incorrect, either gear and bearing, or out-**

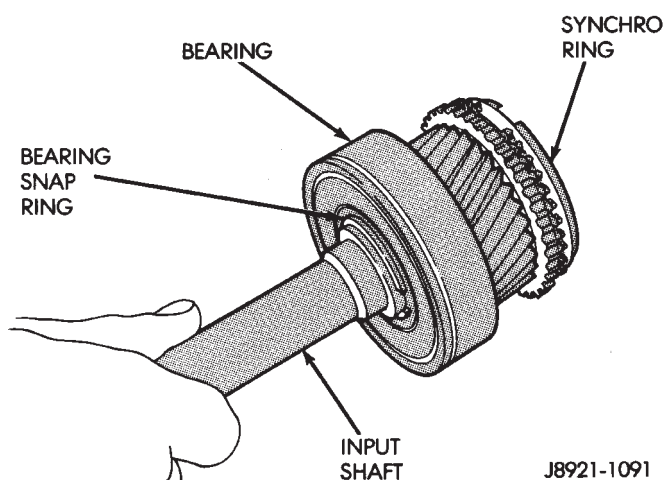


Fig. 61 Input Shaft Components

put shaft flange is worn. Refer to output shaft inspection in Cleaning and Inspection section.

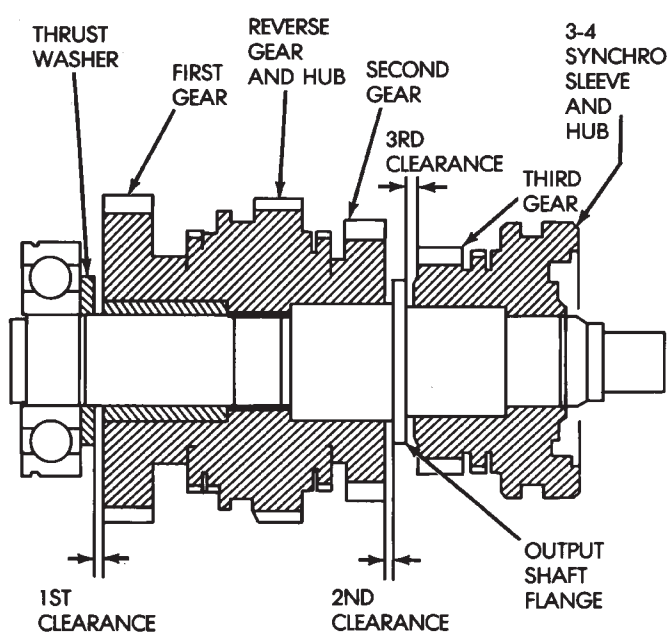
(3) Press fifth gear and rear bearing off rear of output shaft.

(4) Remove thrust washer, pin, and first gear and bearing (Fig. 62).

(5) Remove first/reverse hub snap ring (Fig. 63).

(6) Remove synchro ring.

(7) Press reverse gear and first/reverse hub off shaft as assembly.

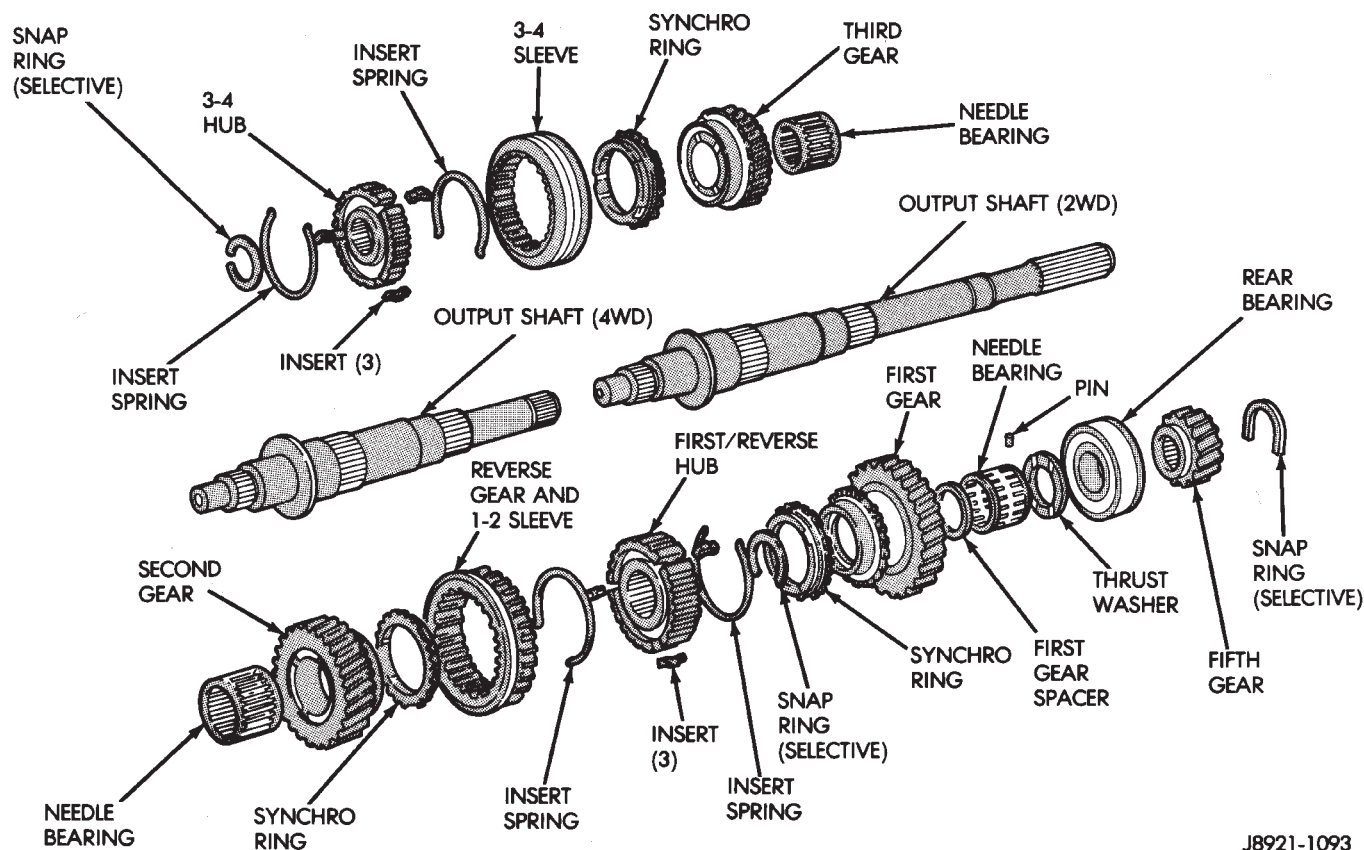


J8921-1092

Fig. 62 Checking Output Shaft Gear Thrust Clearance

(8) Remove remaining synchro ring and second gear and bearing (Fig. 63).

(9) Remove snap ring at front of output shaft (Fig. 63).



J8921-1093

Fig. 63 Output Shaft And Gears

(10) Press 3-4 hub and sleeve off output shaft assembly (Fig. 63).

(11) Remove synchro ring.

(12) Remove third gear and needle bearing (Fig. 63).

TRANSMISSION CLEANING AND INSPECTION

Clean the transmission components in solvent. Dry the cases, gears, shift mechanism and shafts with compressed air. **Dry the bearings with clean, dry shop towels only. Never use compressed air on the bearings. This could damage the bearing rollers.**

Replace components that are obviously worn, cracked, chipped or damaged in any way.

Inspect the transmission case. Replace the case if cracked or porous or if any of the bearing and gear bores are damaged.

Output Shaft Inspection

Measure thickness of the output shaft flange with a micrometer (Fig. 64). Minimum allowable flange thickness is 4.70 mm (0.185 in.).

If shaft flange thickness is OK but previously measured second/third gear thrust clearance was incorrect (Fig. 62), replace the necessary gear and needle bearing as an assembly.

Check diameter of the first, second and third gear bearing surfaces of the output shaft (Fig. 64). Minimum allowable diameters are:

- 38.86 mm (1.529 in.) for first gear surface
- 46.86 mm (1.844 in.) for second gear surface
- 37.86 mm (1.490 in.) for third gear surface

Check output shaft runout with V-blocks and a dial indicator (Fig. 64). Maximum allowable runout is 0.06 mm (0.0024 in.).

Replace the output shaft if any surface measured fails to meet stated tolerance.

Cluster Gear Inspection

Inspect the cluster gear teeth. Replace the gear if any teeth are worn or damaged or if the bearing surfaces are damaged.

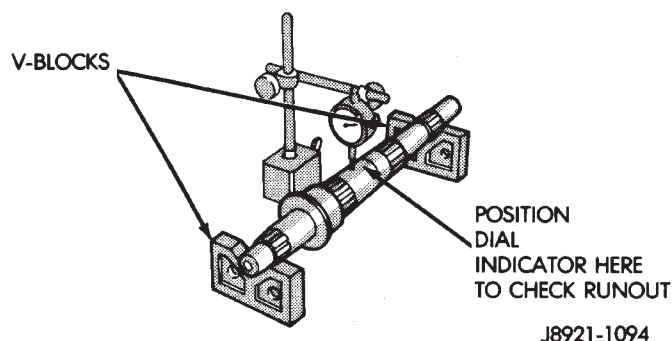
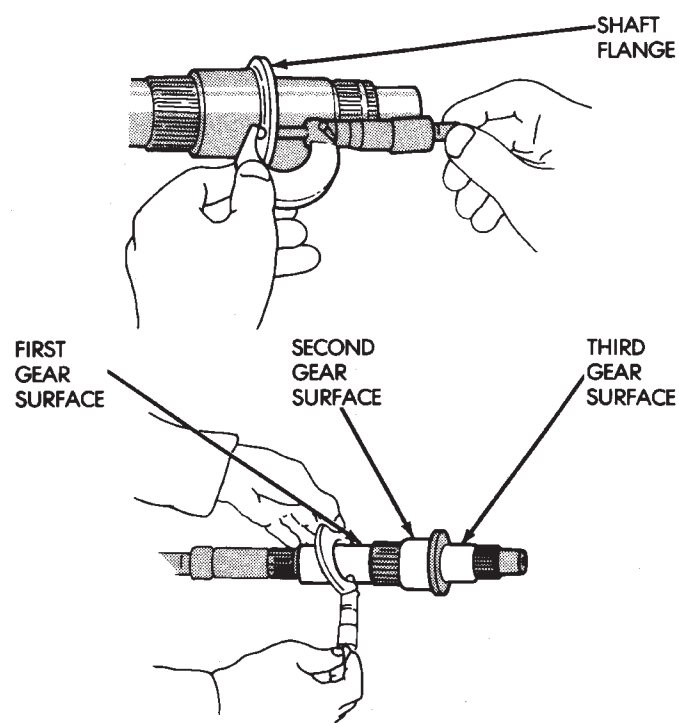
Check diameter of the cluster gear journal with a micrometer (Fig. 65). Minimum allowable diameter is 27.860 mm (1.096 in.).

Check condition of the cluster gear front bearing. Replace the bearing if worn, noisy, or damaged.

GEAR AND SYNCHRO INSPECTION

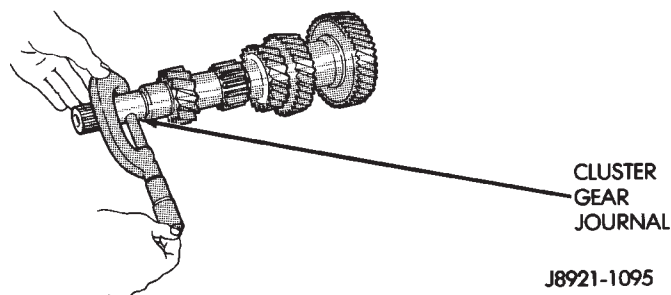
Install the synchro rings on their respective gears. Rotate each ring on the gear and note synchro action. Replace any synchro ring that exhibits a lack of braking action or binds on the gear. Also replace any ring that is worn or has chipped or broken teeth.

Measure end clearance between the synchro ring and the gear with a feeler gauge (Fig. 66). Clearance should be 0.06 mm - 1.6 mm (0.024 - 0.063 in.).



J8921-1094

Fig. 64 Checking Output Shaft Tolerances



J8921-1095

Fig. 65 Checking Cluster Gear Journal Diameter

Install the needle bearings in the first, second and third gears. Then install the gears on the output shaft and check shaft-to-gear clearance with a dial indicator (Fig. 67).

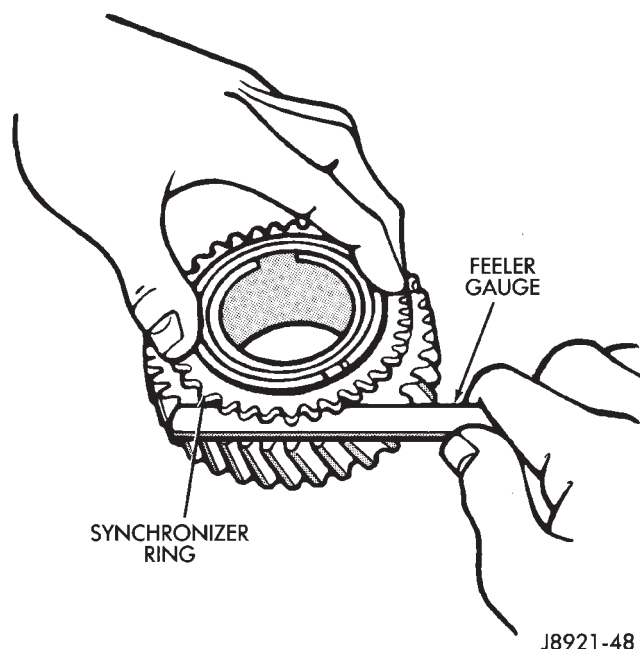


Fig. 66 Checking Synchro Ring End Clearance

Maximum allowable clearance is 0.16 mm (0.0063 in.). If any gear exhibits excessive clearance, replace the gear and needle bearing.

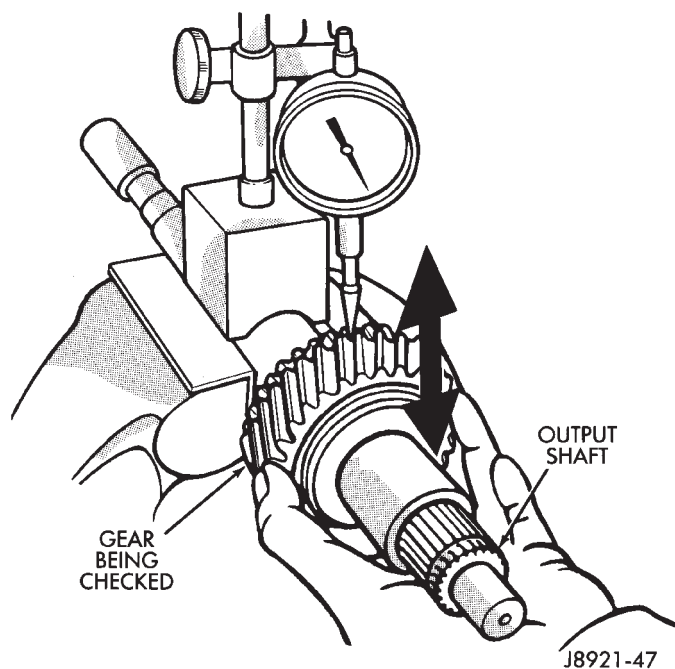


Fig. 67 Checking Gear-To-Shaft Clearance

Check clearance between the shift forks and synchro sleeves with a feeler gauge (Fig. 68). Clearance should not exceed 1.0 mm (0.039 in.). Replace the synchro sleeve (and matching hub) if clearance exceeds the stated limit.

Check condition of the reverse idler gear bushing (Fig. 69). Replace the gear if the bushing is damaged or worn.

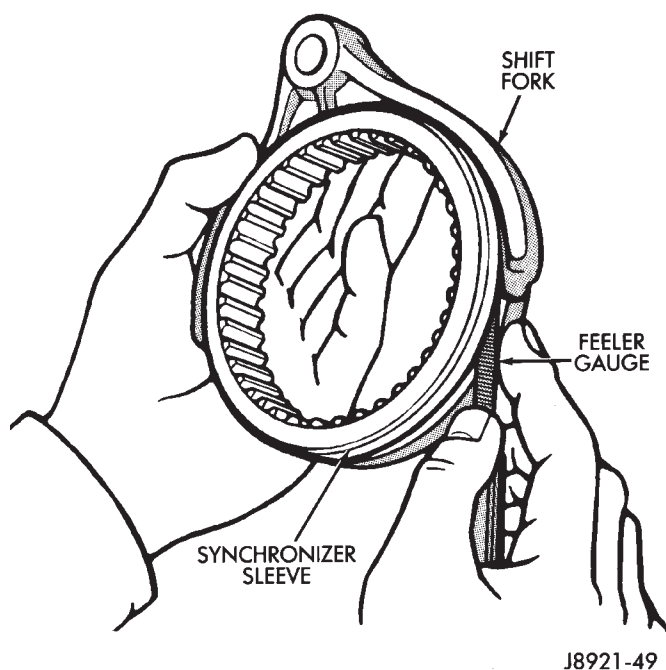


Fig. 68 Checking Shift Fork-To-Sleeve Clearance

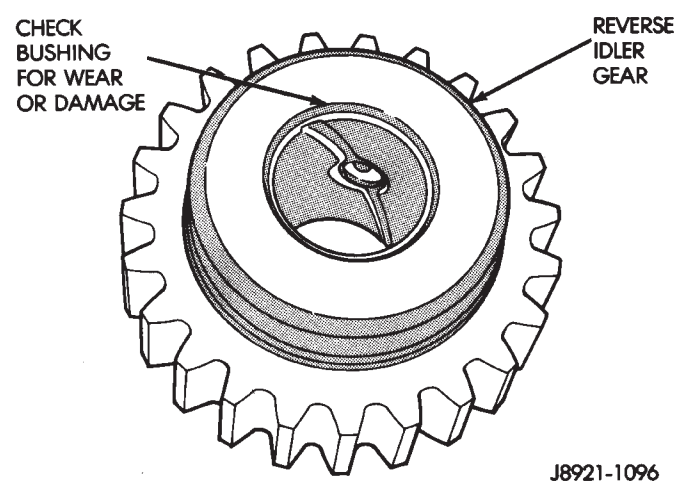


Fig. 69 Reverse Idler Gear Bushing

Gear Case, Housing And Intermediate Plate

Clean the case, housing and plate with solvent and dry with compressed air. Replace any component that is cracked, warped or damaged in any way.

Inspect the threads in the case, housing and plate. Minor thread damage can be repaired with steel thread inserts if necessary. However, do not attempt to repair if the cracks are evident around any threaded hole.

Inspect the reverse pin in the adapter/extension housing. Replace the pin if worn or damaged. Refer to the replacement procedure in the Transmission Assembly section.

TRANSMISSION ASSEMBLY AND ADJUSTMENT

Lubricate the transmission components with Mopar 75W-90 gear lubricant during assembly. Use petroleum jelly to lubricate seal lips and/or hold parts in place during installation.

FRONT BEARING, SEAL AND PIN INSTALLATION

(1) Press front bearing on input shaft. Then secure bearing with thickest snap ring that will fit in shaft groove (Fig. 70).

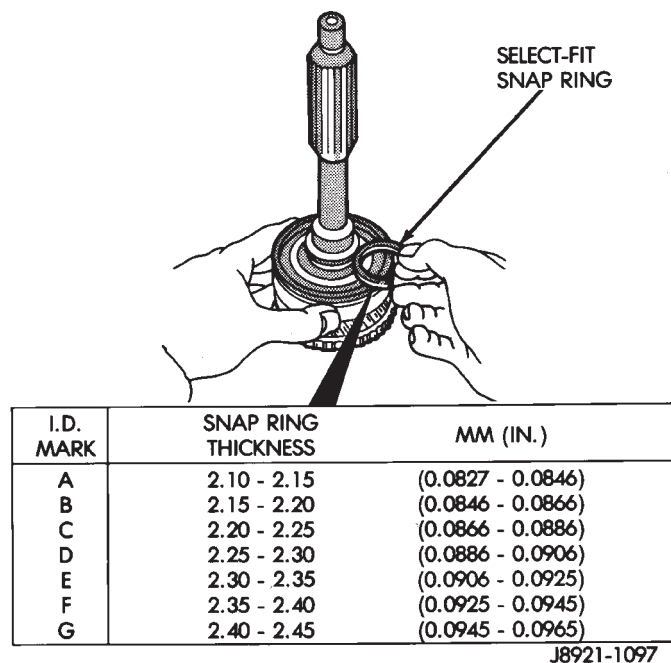


Fig. 70 Selecting Input Shaft Front Bearing Snap Ring

(2) Press front bearing on cluster gear. Then secure bearing with thickest snap ring that will fit in ring groove on gear (Fig. 71).

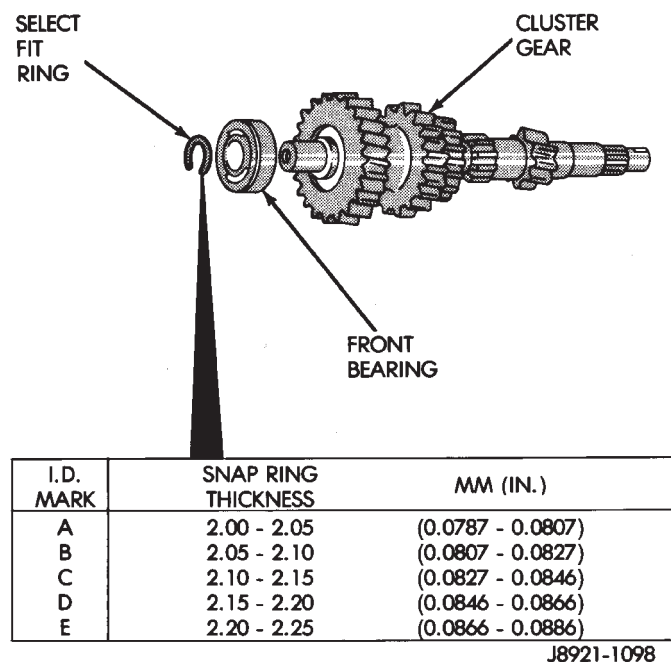


Fig. 71 Selecting Cluster Gear Front Bearing Snap Ring

(3) Install new oil seals in front bearing retainer and adapter housing (Fig. 72). Installation depth for bearing retainer seal is 10.5 - 11.5 mm (0.414 - 0.453 in.).

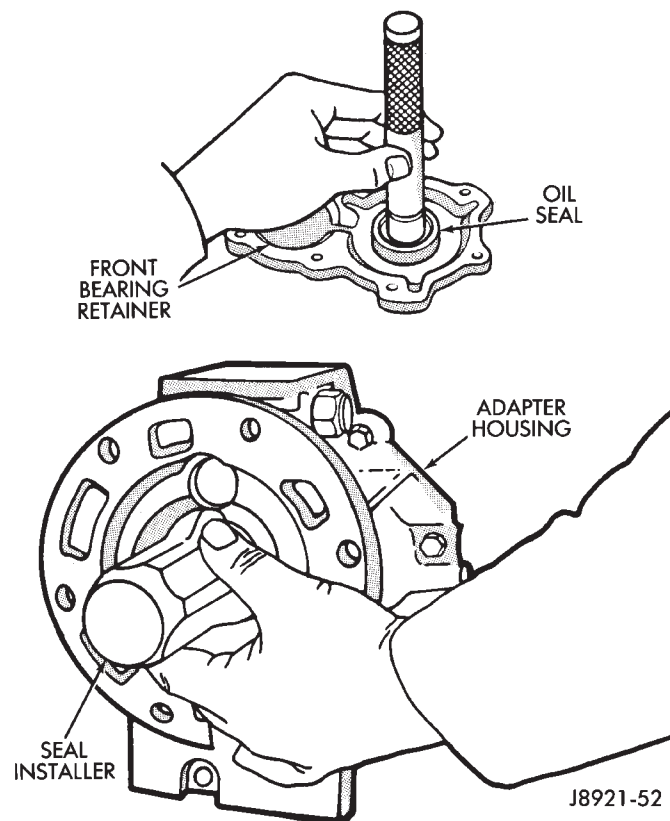


Fig. 72 Oil Seal Installation

(4) Install reverse shaft and shaft retaining pin in adapter housing. Then install access hole plug with torx bit (Fig. 73).

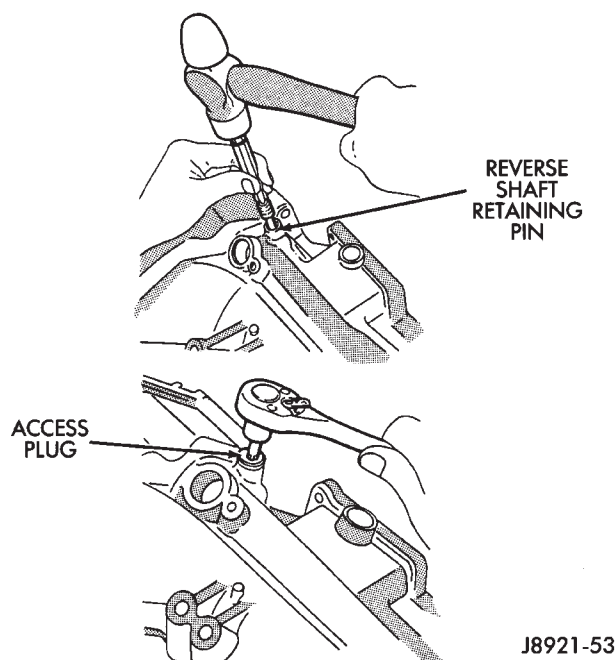


Fig. 73 Installing Reverse Shaft Pin

(5) Lubricate reverse shaft and gear components with Mopar 75W-90 gear lubricant.

OUTPUT SHAFT ASSEMBLY

- (1) Lubricate output shaft journals, gears and needle bearings with Mopar 75W-90 gear lubricant.
- (2) Install third gear and needle bearing on shaft (Fig. 63)
- (3) Install synchro ring on third gear (Fig. 63).
- (4) Assemble 1-2 and 3-4 synchro hubs and sleeves (Fig.74).

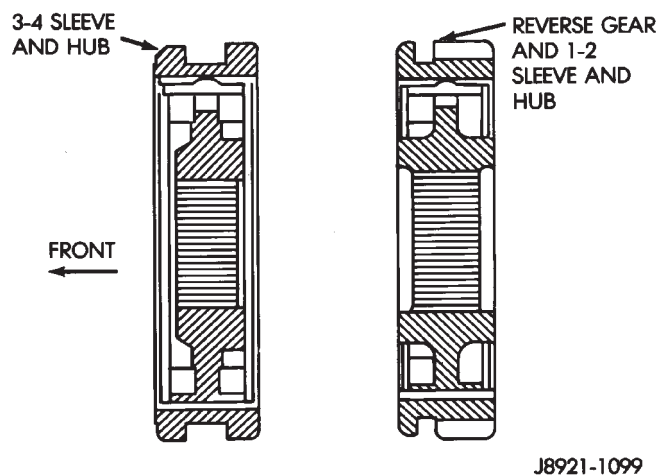


Fig. 74 Synchro Sleeve And Hub Identification

(5) Install inserts and springs in synchro sleeves. Position open ends of springs 180° apart as shown (Fig. 75).

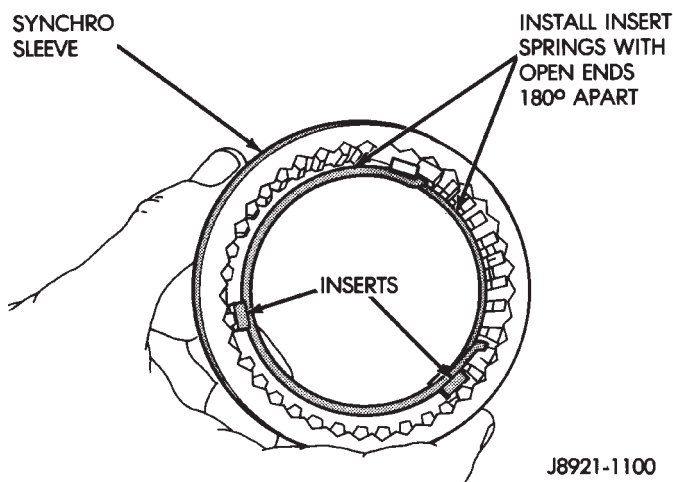
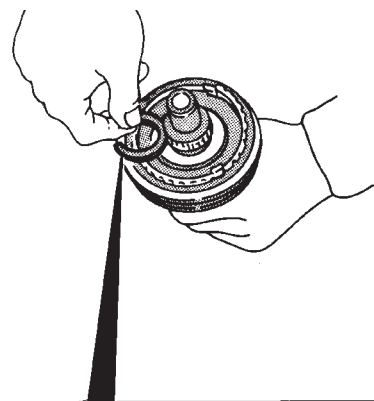


Fig. 75 Insert Spring Position

- (6) Install 3-4 synchro hub and sleeve on output shaft. Press hub onto shaft if necessary.
- (7) Install 3-4 synchro hub snap ring (Fig. 76). Use thickest snap ring that will fit in shaft groove.
- (8) Verify third gear thrust clearance with feeler gauge (Fig. 56). Clearance should be 0.10 - 0.25 mm (0.004 - 0.010 in.).



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	1.80 - 1.85	(0.0709 - 0.0728)
B	1.85 - 1.90	(0.0728 - 0.0748)
C	1.90 - 1.95	(0.0748 - 0.0768)
D	1.95 - 2.00	(0.0768 - 0.0787)
E	2.00 - 2.05	(0.0787 - 0.0807)
F	2.05 - 2.10	(0.0807 - 0.0827)
G	2.10 - 2.15	(0.0827 - 0.0846)

J8921-1101

Fig. 76 Installing 3-4 Synchro Hub Snap Ring

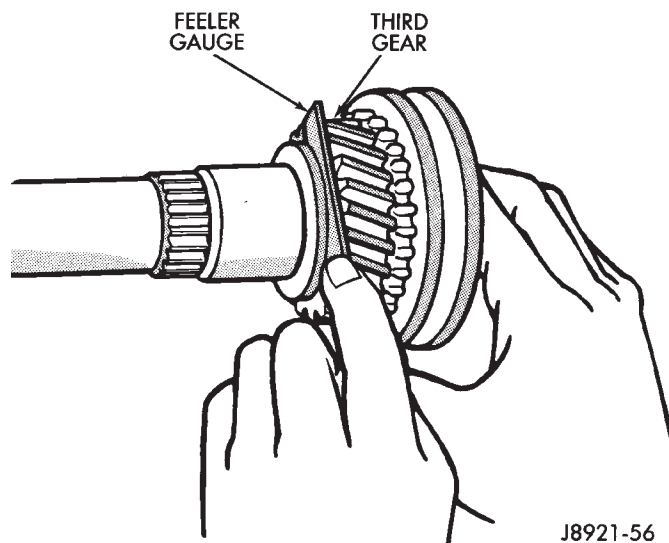
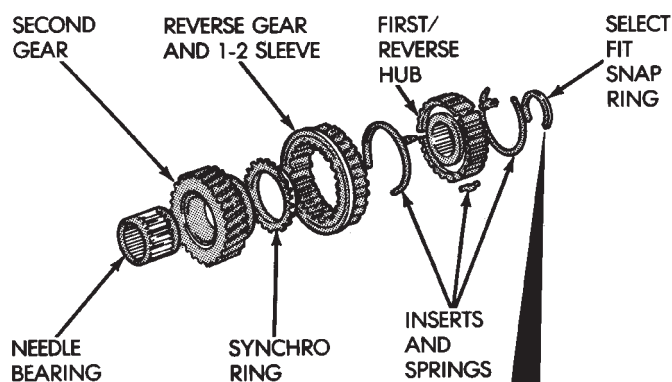


Fig. 77 Checking Third Gear Clearance

- (9) Lubricate remaining output shaft gears and bearings with gear lubricant.
- (10) Install second gear and needle bearing on shaft (Fig. 78).
- (11) Install synchro ring on second gear (Fig. 78).
- (12) Assemble first/reverse hub, insert springs, inserts, reverse gear and 1-2 sleeve (Fig. 78). **Be sure spring ends are 180° apart. Note that splines in hub bore are chamfered on one side. Install hub so chamfered side faces front of output shaft.**
- (13) Press assembled hub and sleeve on output shaft.
- (14) Install selective snap ring (Fig. 78). Use thickest snap ring that will fit in output shaft groove.
- (15) Install synchro ring on first gear (Fig. 79).



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
B	2.35 - 2.40	(0.0925 - 0.0945)
C	2.40 - 2.45	(0.0945 - 0.0965)
D	2.45 - 2.50	(0.0965 - 0.0984)
E	2.50 - 2.55	(0.0984 - 0.1004)
F	2.55 - 2.60	(0.1004 - 0.1024)
G	2.60 - 2.65	(0.1024 - 0.1043)

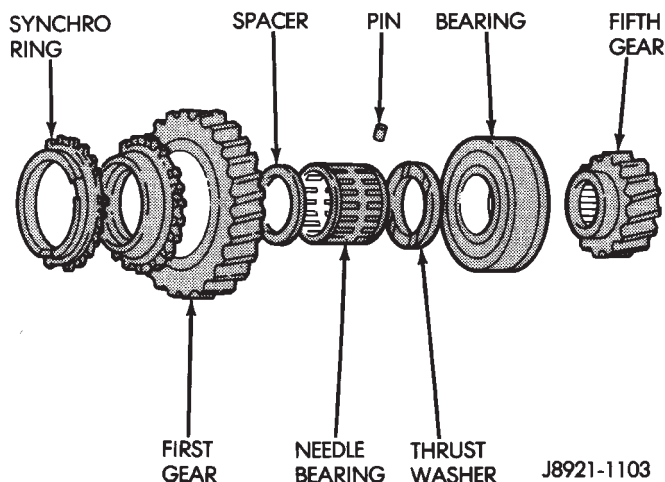
J8921-1102

Fig. 78 Second Gear And Synchro Assembly

(16) Install first gear spacer on shaft and against selective fit snap ring (Fig. 79).

(17) Install first gear and needle bearing (Fig. 79) on output shaft.

(18) Install locating pin and thrust washer on shaft (Fig. 79).



J8921-1103

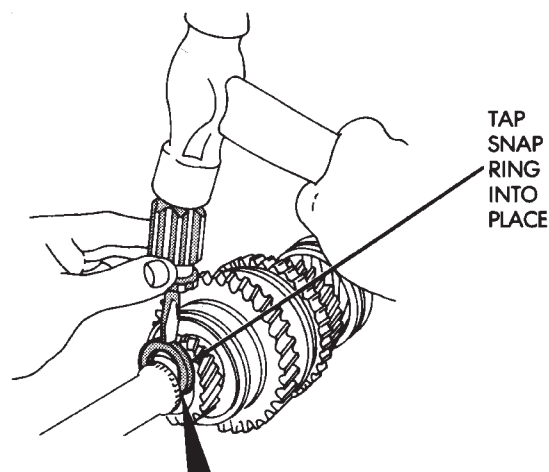
Fig. 79 First And Fifth Gear Components

(19) Press rear bearing on shaft. Position bearing snap ring groove so it is closest to end of output shaft.

(20) Check first and second gear thrust clearance with feeler gauge (Fig. 62).

- First gear clearance should be 0.10 - 0.40 mm (0.003 - 0.0197 in.)
- Second gear clearance should be 0.10 - 0.30 mm (0.003 - 0.0118 in.)

(21) Press fifth gear onto output shaft. Then install select fit snap ring (Fig. 80). Use thickest snap ring that will fit in shaft groove.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.75 - 2.80	(0.1083 - 0.1102)
B	2.80 - 2.85	(0.1002 - 0.1122)
C	2.85 - 2.90	(0.1122 - 0.1142)
D	2.90 - 2.95	(0.1142 - 0.1161)
E	2.95 - 3.00	(0.1161 - 0.1181)
F	3.00 - 3.05	(0.1181 - 0.1201)
G	3.05 - 3.10	(0.1201 - 0.1220)
H	3.10 - 3.15	(0.1220 - 0.1240)
J	3.15 - 3.20	(0.1240 - 0.1260)
K	3.20 - 3.25	(0.1260 - 0.1280)
L	3.25 - 3.30	(0.1280 - 0.1299)
M	3.30 - 3.35	(0.1299 - 0.1319)

J8921-1104

Fig. 80 Selecting Fifth Gear Snap Ring

(22) Lubricate input shaft pilot bearing with petroleum jelly and install bearing in shaft (Fig. 60).

(23) Install input shaft on output shaft (Fig. 59). Be sure output shaft hub is fully seated in pilot bearing.

OUTPUT SHAFT AND CLUSTER GEAR INSTALLATION

(1) Mount intermediate plate in vise (Fig. 24).

(2) Lubricate cluster gear journal and rear bearing with petroleum jelly or gear lubricant.

(3) Install cluster gear rear bearing in intermediate plate (Fig. 81). Be sure snap ring groove in bearing is rearward as shown.

(4) Start cluster gear into bearing (Fig. 57). Then hold bearing and push gear into place. Use plastic or rawhide mallet to seat bearing if necessary.

(5) Start output shaft rear bearing in intermediate plate. Push shaft rearward and tap intermediate plate with mallet to seat bearing.

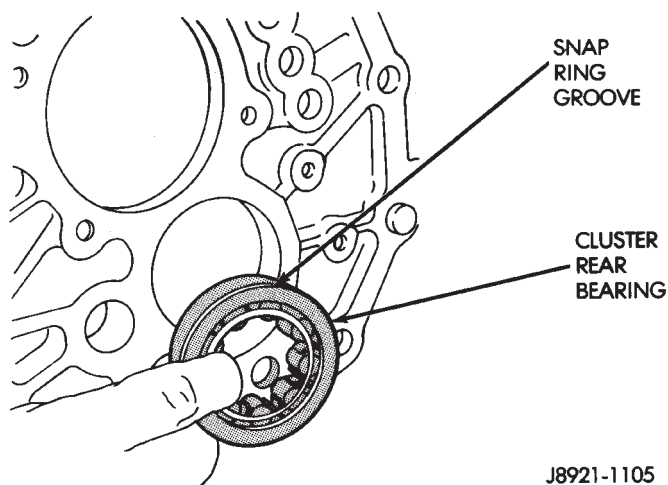


Fig. 81 Installing Cluster Gear Rear Bearing

(6) Install snap rings on cluster and output shaft **rear** bearings only (Fig. 82). Do not install front bearing snap rings at this time.

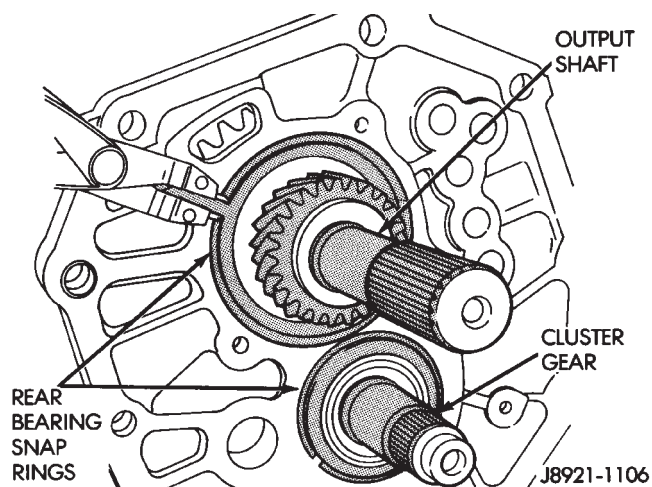


Fig. 82 Installing Rear Bearing Snap Rings

(7) Install reverse idler gear and shaft (Fig. 83).

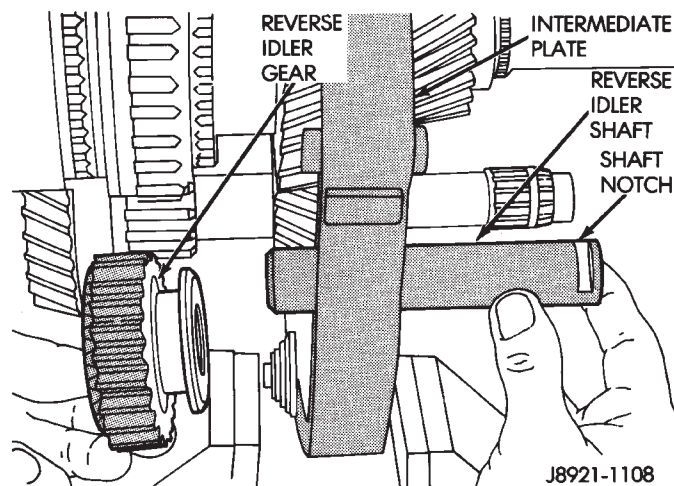


Fig. 83 Installing Reverse Idler Gear And Shaft

(8) Position rear bearing retainer over output shaft and rear bearing. **Be sure bearing retainer tab is engaged in reverse idler shaft notch (Fig. 84).**

(9) Install and tighten rear bearing retainer bolts to 18 N·m (13 ft-lbs).

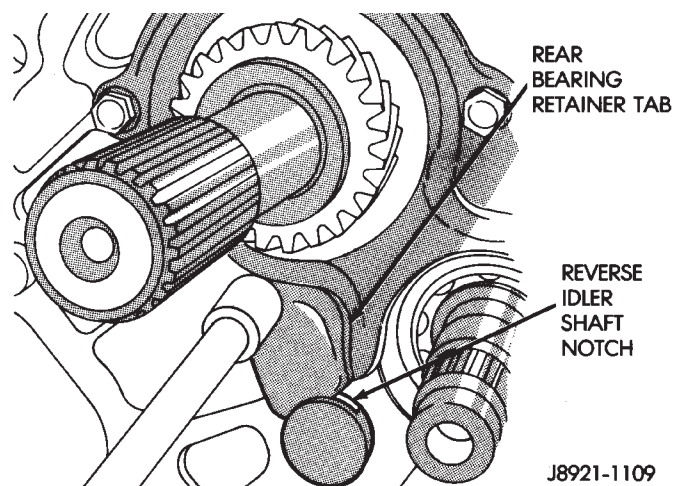


Fig. 84 Installing Rear Bearing Retainer

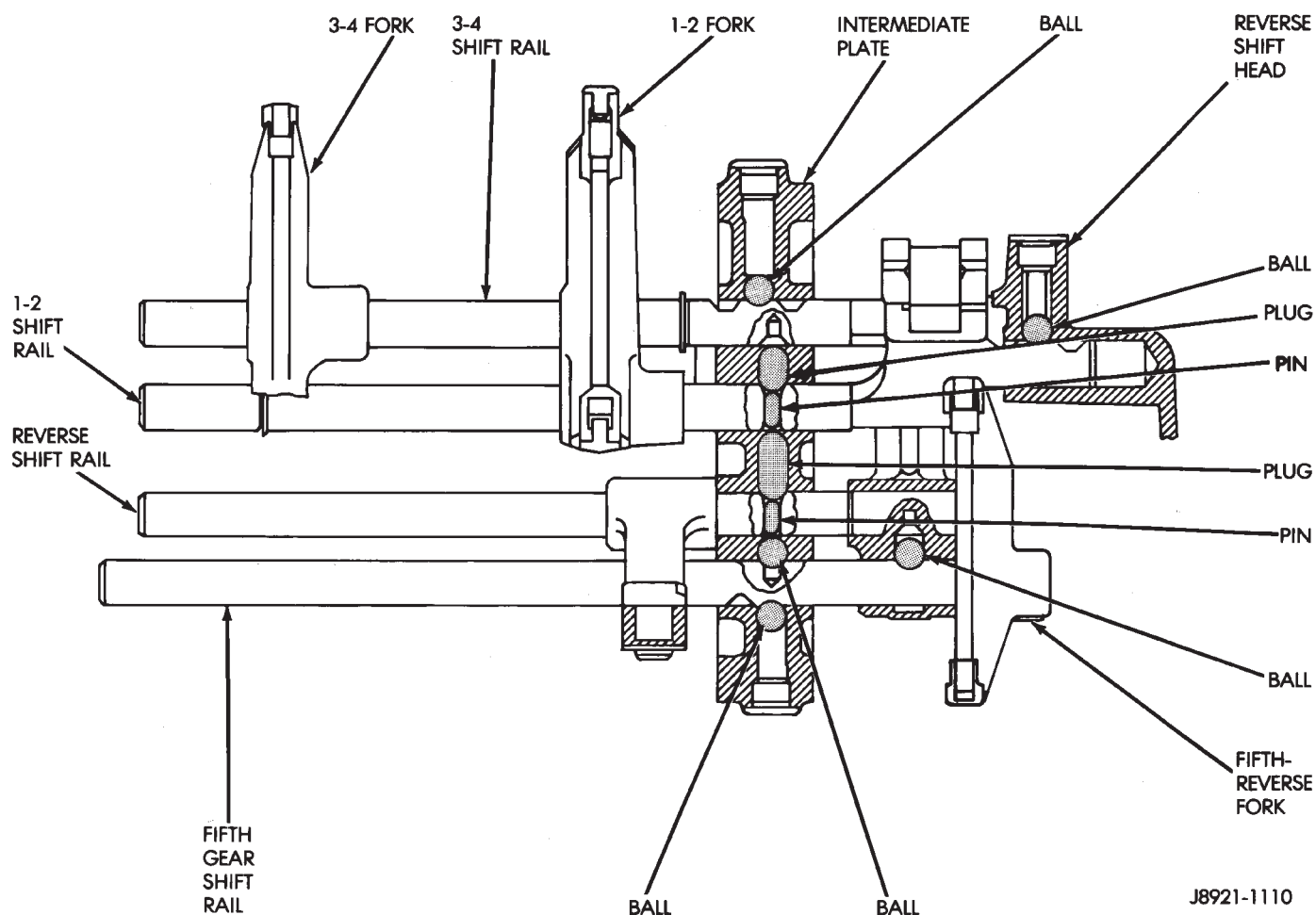


Fig. 85 Shift Rail Ball-Plug-Pin Position

SHIFT RAIL AND FORK INSTALLATION

The shift rail interlock pins, balls and plugs must be installed in the correct sequence for proper shifting. Refer to the installation diagram (Fig. 85) during assembly.

Coat the intermediate plate shift rail bores and the interlock balls, pins and plugs with a heavy coating of petroleum jelly before assembly. The jelly will hold the interlock components in place making installation easier. Use a pencil magnet to hold and insert the interlocks. Then use a small screwdriver to push the interlock components into place.

(1) Coat reverse rail interlock pin with petroleum jelly and install pin in rail (Fig. 86).

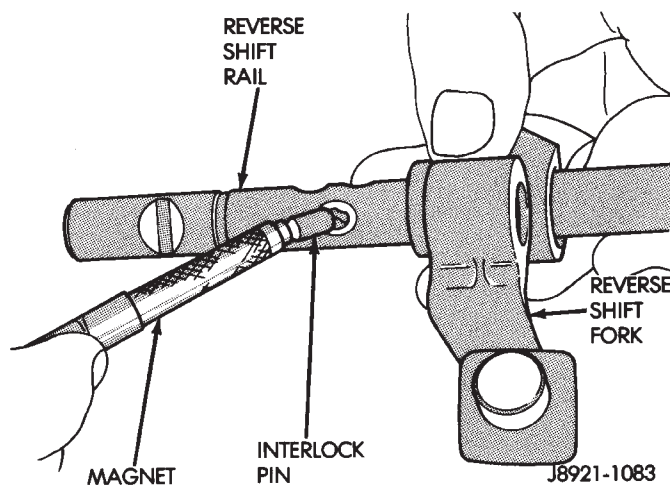


Fig. 86 Installing Reverse Shift Rail Interlock Pin

(2) Install reverse shift rail in intermediate plate (Fig. 87).

(3) Install reverse shift rail C-ring (Fig. 51).

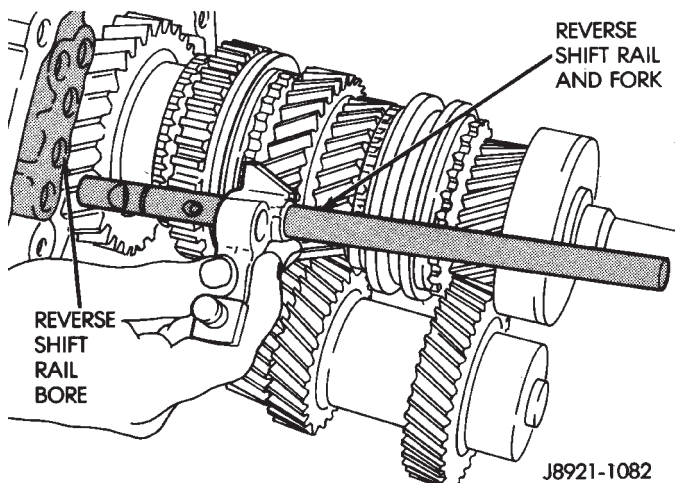


Fig. 87 Installing Reverse Shift Rail And Fork

(4) Position 1-2 and 3-4 shift forks in synchro sleeves (Fig. 88).

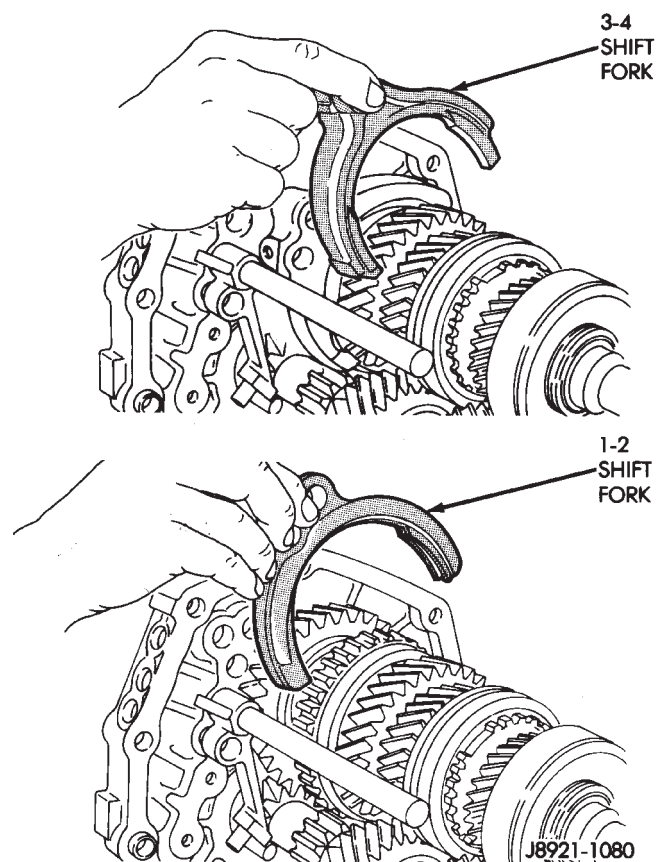


Fig. 88 Shift Fork Installation

(5) Coat reverse rail lock ball with petroleum jelly. Then tilt reverse shift fork upward and insert ball in intermediate plate (Fig. 89).

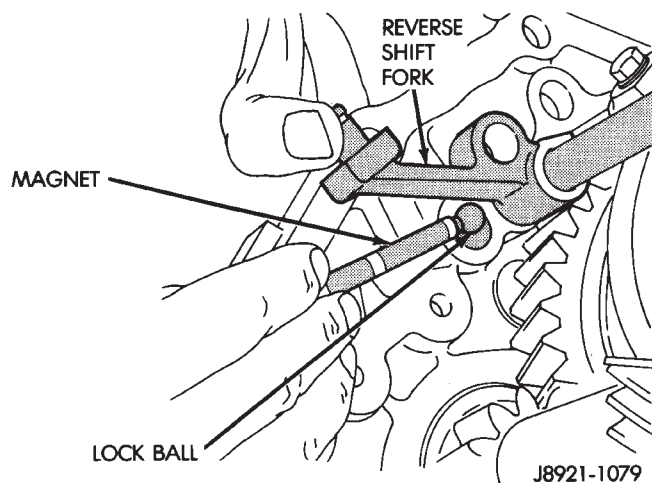


Fig. 89 Installing Reverse Shift Rail Lock Ball

(6) Coat 1-2 shift rail interlock plug with petroleum jelly and install it in intermediate plate bore (Fig. 90).

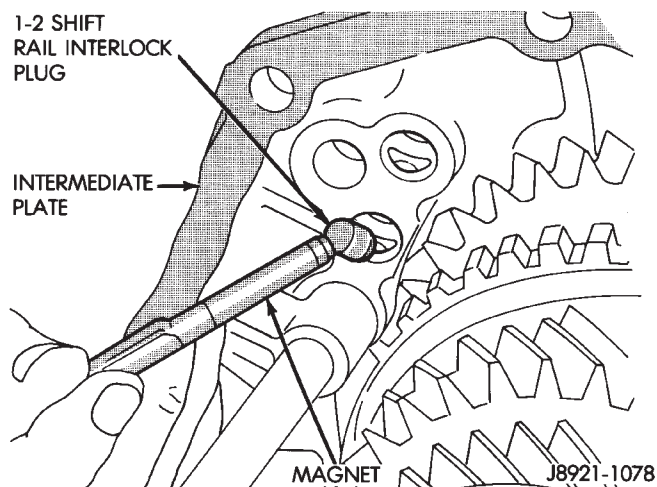


Fig. 90 Installing 1-2 Shift Rail Interlock Plug

(7) Coat 1-2 shift rail interlock pin with petroleum jelly and insert it in shift rail (Fig. 91).

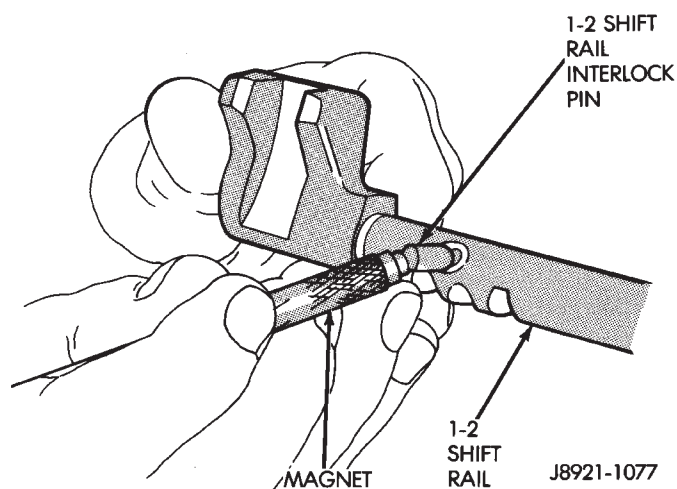


Fig. 91 Installing 1-2 Shift Rail Interlock Pin

(8) Install 1-2 shift rail in intermediate plate and 1-2 fork (Fig. 92).

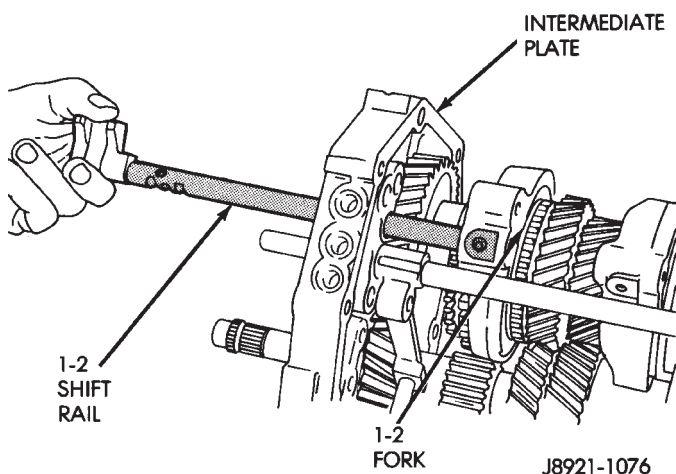


Fig. 92 Installing 1-2 Shift Rail

(9) Coat 3-4 shift rail interlock plug with petroleum jelly and install plug in intermediate plate (Fig. 93).

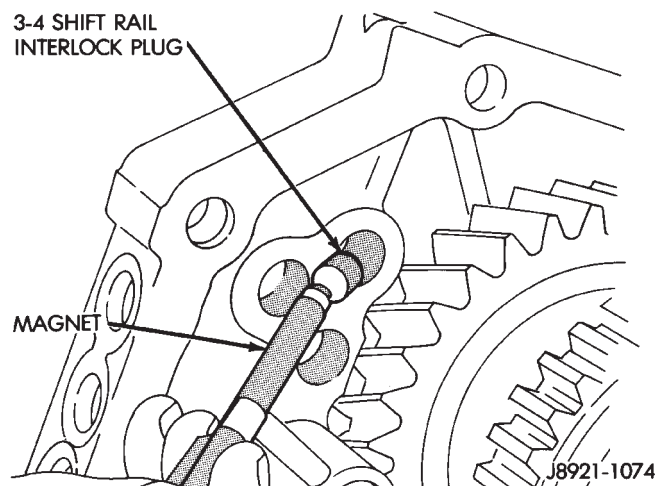


Fig. 93 Installing 3-4 Shift Rail Interlock Plug

(10) Install 3-4 shift rail in intermediate plate and in both shift forks (Fig. 94).

(11) Verify that none of interlock balls, plugs, or pins were displaced during shift rail installation.

(12) Install and tighten shift fork setscrews to 20 N·m (14 ft. lbs.) torque (Fig. 95).

(13) Install 1-2 and 3-4 shift rail C-rings (Fig. 96).

(14) Insert fifth gear shift rail through reverse shift fork. **Then slide rail into intermediate plate just far enough to secure interlock ball. Do not fully install shift rail at this time.**

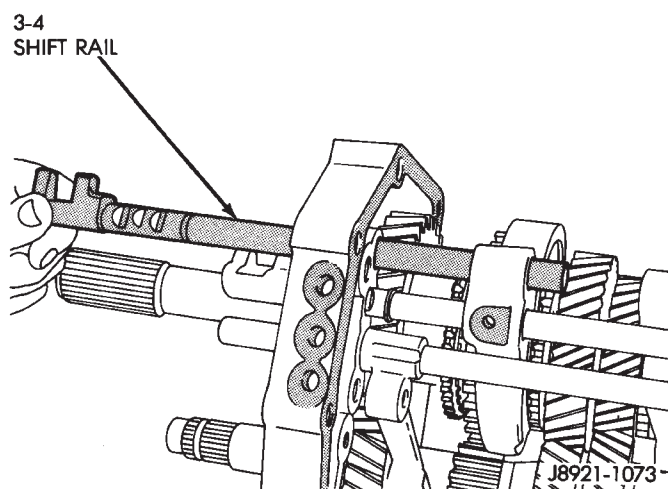


Fig. 94 Installing 3-4 Shift Rail

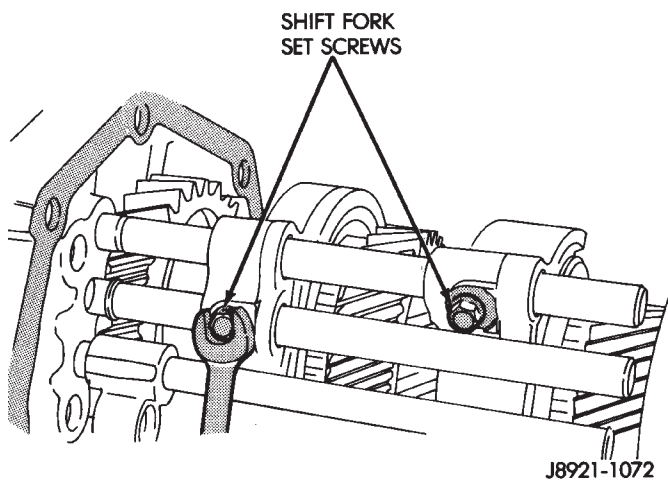


Fig. 95 Installing Shift Fork Set Screws

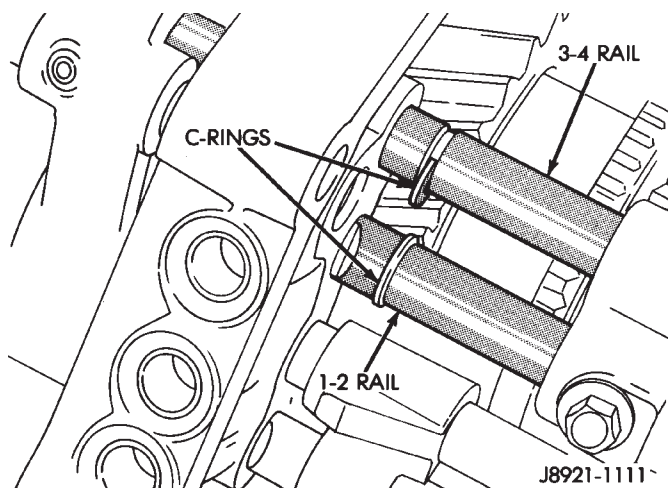


Fig. 96 Installing Shift Rail C-Rings

FIFTH-REVERSE GEAR AND SHIFT COMPONENT INSTALLATION

(1) Install thrust ring lock ball in cluster gear journal (Fig. 97). Use petroleum jelly to hold ball in place.

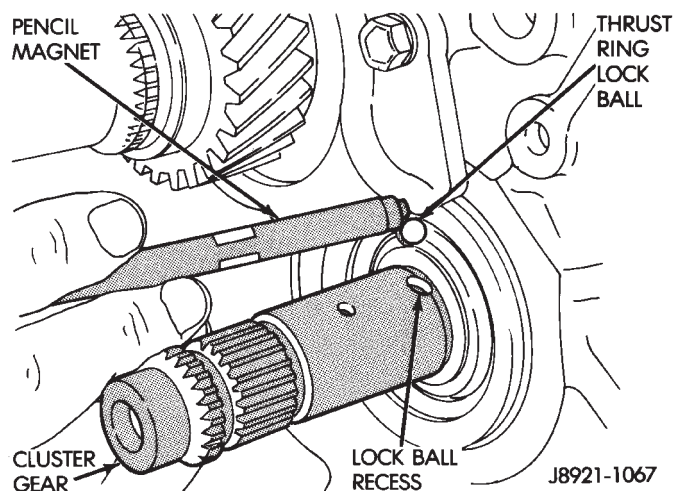


Fig. 97 Installing Thrust Ring Lock Ball

(2) Install fifth gear thrust ring (Fig. 98). Be sure thrust ring notch fits over lock ball.

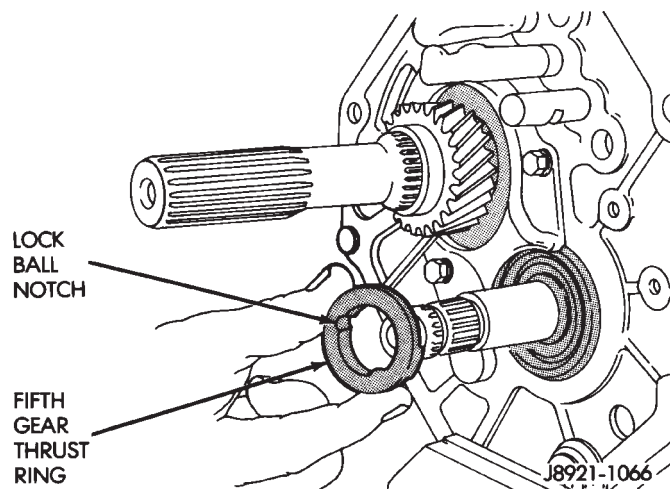


Fig. 98 Installing Fifth Gear Thrust Ring

(3) Assemble counter fifth gear, synchro sleeve, inserts and insert springs (Fig. 99).

(4) Lubricate two-piece bearing with petroleum jelly and install it in counter fifth gear (Fig. 100).

(5) Install counter fifth gear and synchro assembly on cluster gear journal (Fig. 101).

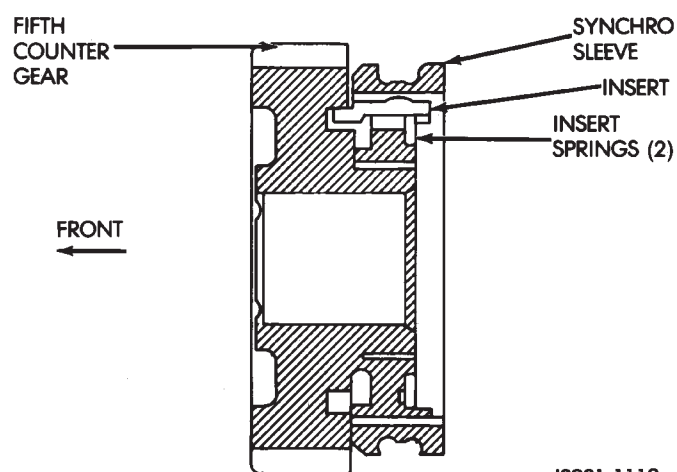


Fig. 99 Assembling Fifth Gear And Synchro Assembly

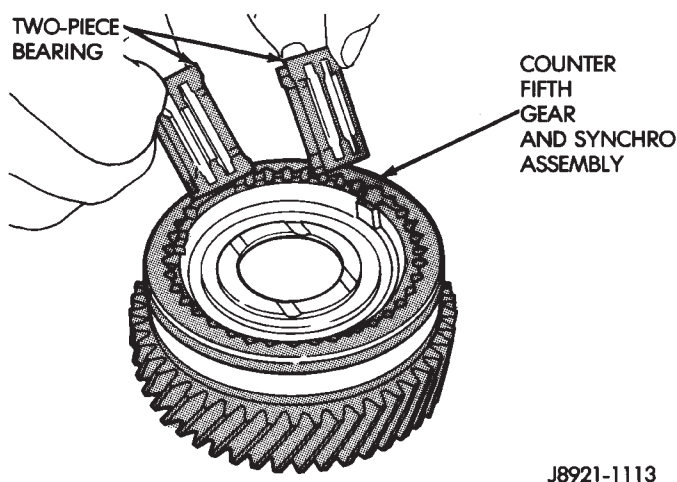


Fig. 100 Installing Counter Fifth Gear Bearing

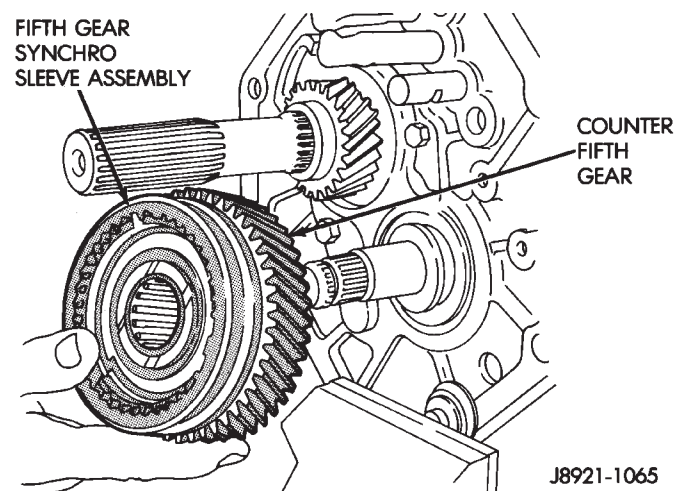


Fig. 101 Installing Counter Fifth Gear And Sleeve

(6) Install synchro ring in synchro sleeve (Fig. 102).

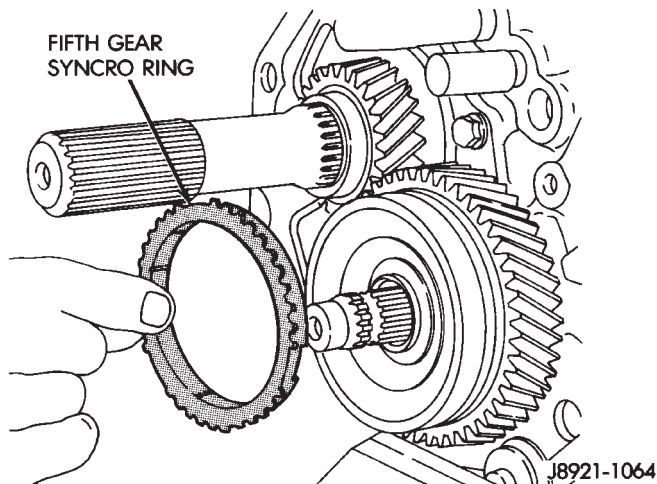


Fig. 102 Installing Fifth Gear Synchro Ring

(7) Install fifth spline gear on cluster journal (Fig. 103). Tap spline gear into place with plastic mallet if necessary.

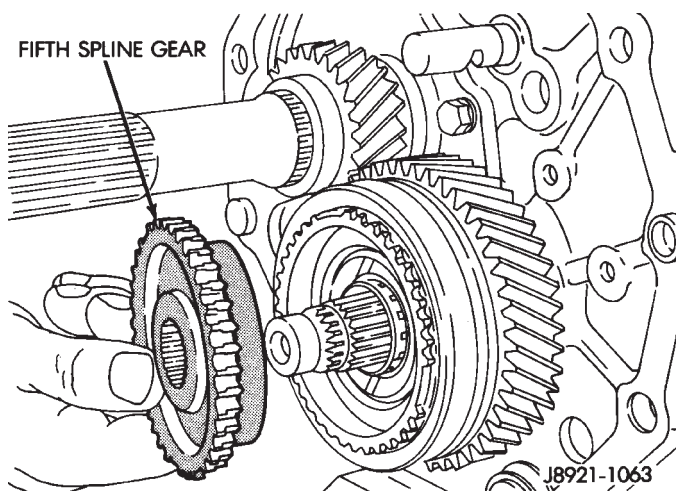


Fig. 103 Installing Fifth Spline Gear

(8) Install fifth gear selective snap ring (Fig. 104). Use thickest snap ring that will fit in shaft groove.

(9) Install reverse shift head and rail (Fig. 105). Then install lock ball in shift head.

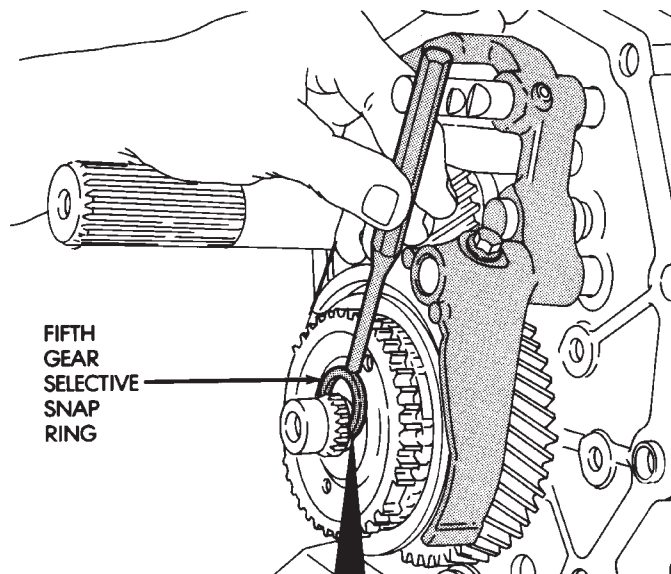
(10) Position fifth gear shift fork in synchro sleeve (Fig. 106).

(11) Install fifth gear shift rail (Fig. 107). Slide rail through fork, shift head, intermediate plate and reverse shift fork. Be sure interlock ball is not displaced during installation.

(12) Align screw holes in shift fork and rail and install set screw (Fig. 108). Tighten screw to 20 N·m (15 ft. lbs.) torque.

(13) Install lock balls and springs in intermediate plate (Fig. 109). Then install and tighten lock ball plugs to 19 N·m (14 ft. lbs.) torque.

(14) Install reverse shift arm bracket (Fig. 110). Tighten bracket bolts to 18 N·m (13 ft. lbs.) torque.



I.D. MARK	SNAP RING THICKNESS	MM (IN.)
A	2.85 - 2.90	(0.1122 - 0.1142)
B	2.90 - 2.95	(0.1142 - 0.1161)
C	2.95 - 3.00	(0.1161 - 0.1181)
D	3.00 - 3.05	(0.1181 - 0.1201)
E	3.05 - 3.10	(0.1201 - 0.1220)
F	3.10 - 3.15	(0.1220 - 0.1240)
G	3.15 - 3.20	(0.1240 - 0.1260)
H	3.20 - 3.25	(0.1260 - 0.1280)

J8921-1114

Fig. 104 Installing Fifth Gear Snap Ring

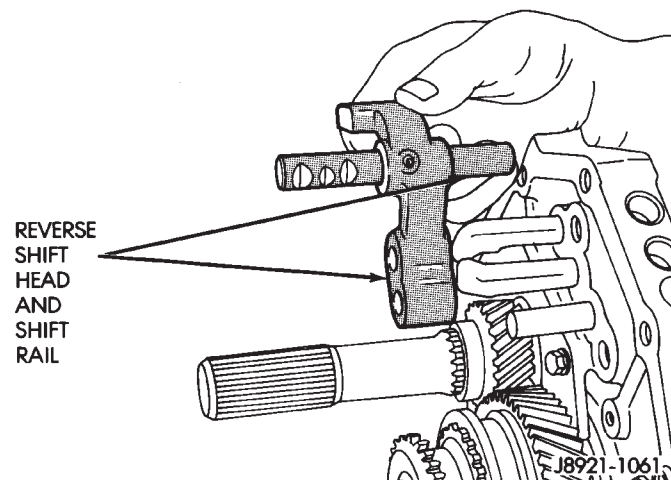


Fig. 105 Installing Reverse Shift Head And Rail

(15) Install reverse shift arm (Fig. 110). Position arm on reverse fork pin and engage it with pin on shift arm bracket.

(16) Verify that shift arm shoe is engaged in reverse idler gear. Then secure shift arm to pin on reverse fork with new E-clip.

GEAR CASE AND ADAPTER INSTALLATION

(1) Dismount intermediate and gear assemblies from vise.

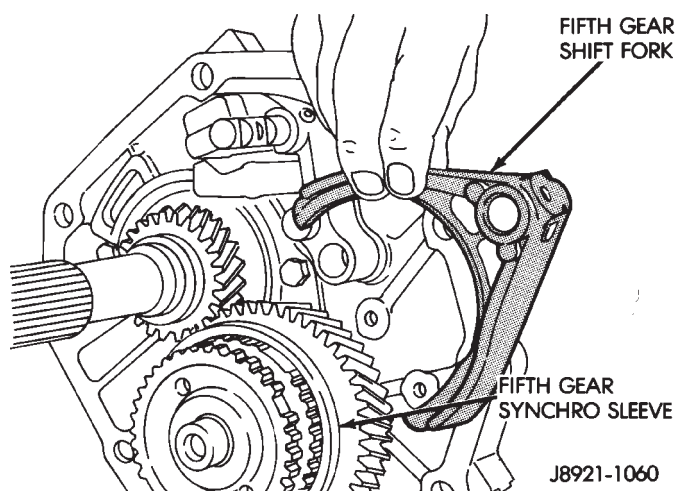


Fig. 106 Installing Fifth Gear Shift Fork

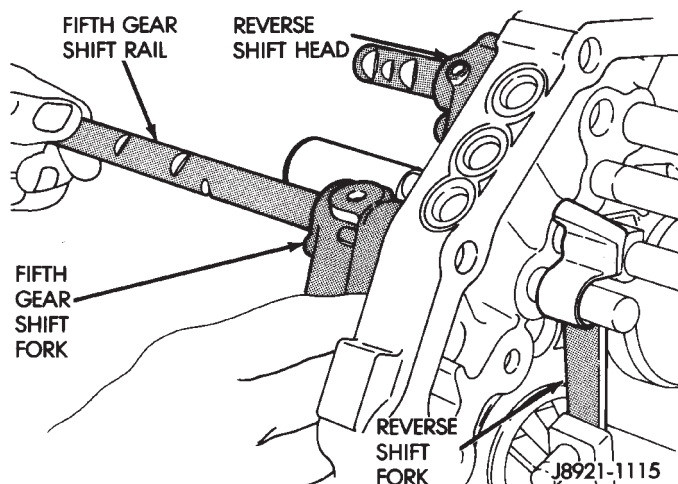


Fig. 107 Installing Fifth Gear Shift Rail

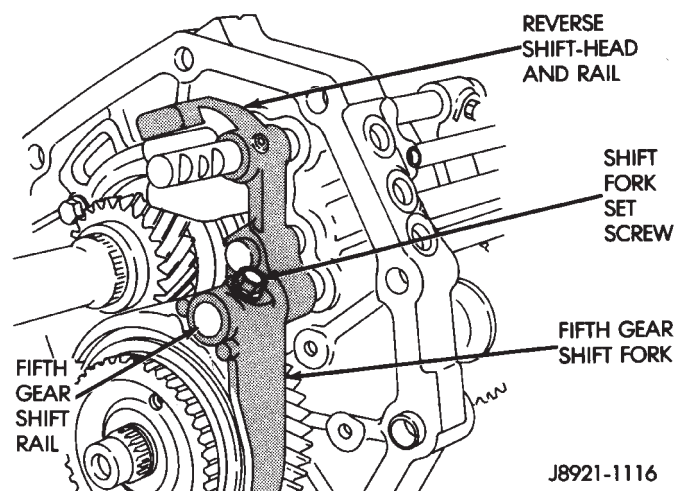


Fig. 108 Shift Fork Set Screw Installation

(2) Clean mating surfaces of intermediate plate and transmission gear case with wax and grease remover. Then wipe dry with a clean cloth.

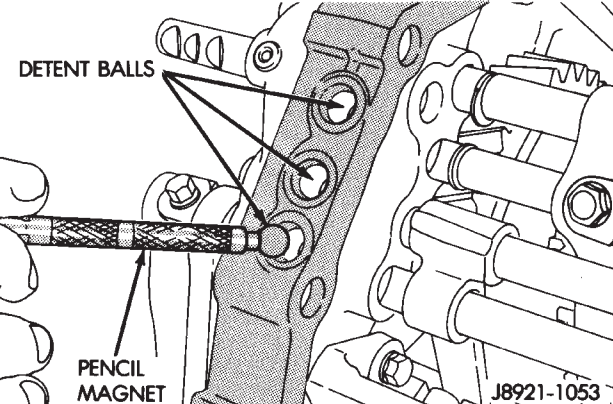
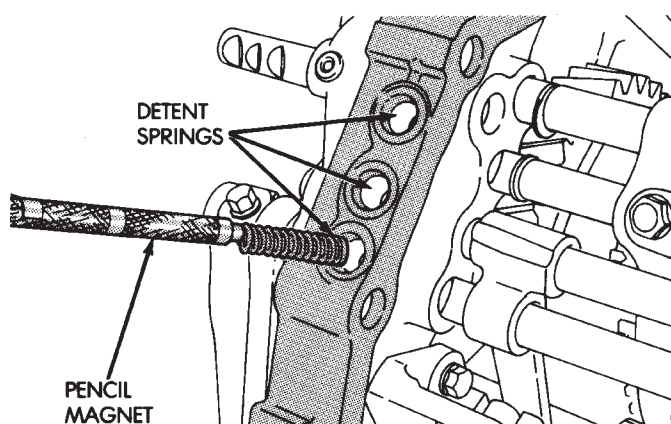


Fig. 109 Detent Ball And Spring Installation

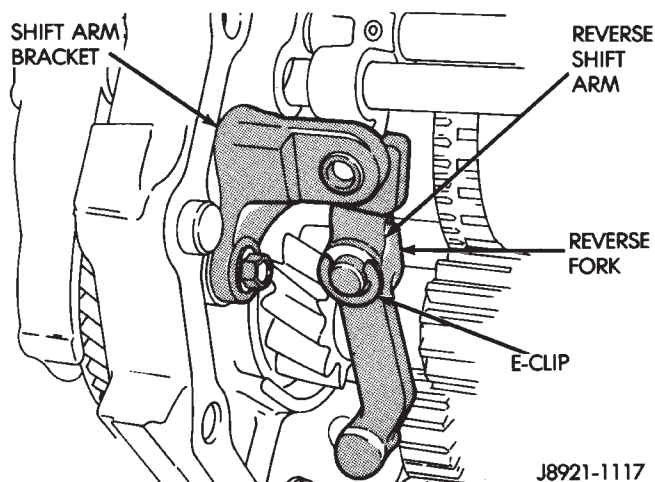
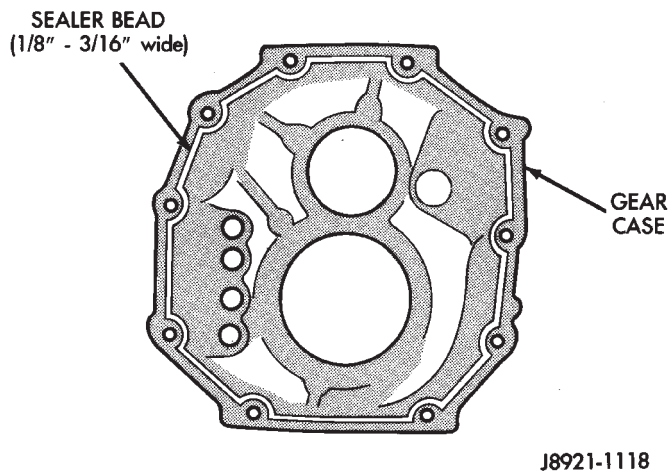


Fig. 110 Reverse Shift Arm And Bracket Installation

(3) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker to mating surface of gear case. Keep sealer bead inside bolt holes as shown (Fig. 111).

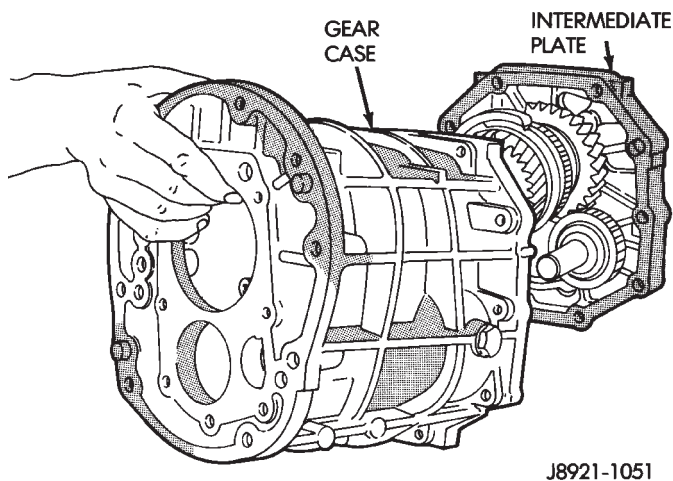


J8921-1118

Fig. 111 Applying Sealer To Gear Case

(4) Install gear case (Fig. 112). Align shift rails and bearings in case and tap case into position.

(5) Verify that gear case is seated on intermediate plate dowel pins.



J8921-1051

Fig. 112 Installing Gear Case

(6) Install front bearing snap rings (Fig. 113).

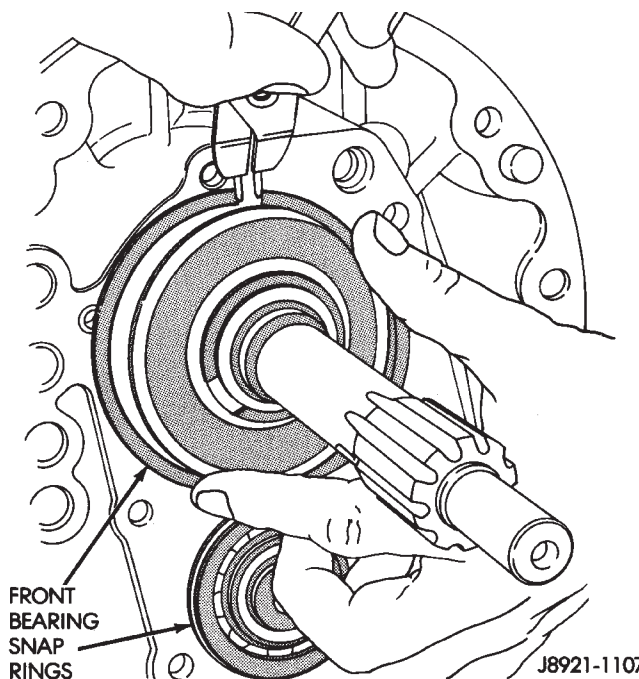
(7) Clean gear case and front bearing retainer sealing surfaces with wax and grease remover. Then wipe dry with a clean cloth.

(8) Install new seal in front bearing retainer. Then lubricate seal lip with petroleum jelly. **Installation depth for seal is 10.5 - 11.5 mm (0.413 - 0.453 in.).**

(9) Apply a 3 mm (1/8 in.) wide bead of Mopar Gasket Maker to front bearing retainer sealing surface.

(10) Align and install front bearing retainer (Fig. 114). Be sure retainer is properly seated on case and bearings.

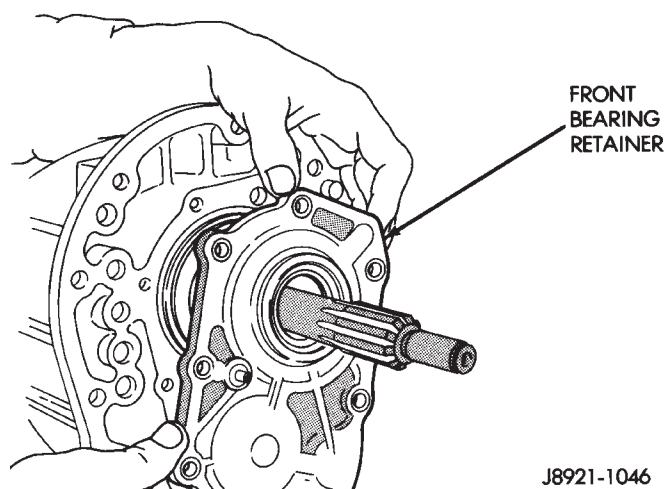
(11) Install and tighten front bearing retainer bolts to 17 N·m (12 ft. lbs.) torque.



J8921-1107

Fig. 113 Installing Front Bearing Snap Rings

(12) On 2-wheel drive models, install speedometer gear, lock ball and retaining rings (Fig. 115). Be sure lock ball is engaged in gear.



J8921-1046

Fig. 114 Installing Front Bearing Retainer

(13) Inspect condition of reverse pin in adapter/extension housing (Fig. 116). If pin is worn or damaged, replace it as follows:

(a) Remove roll pin access plug (Fig. 117).

(b) Tap roll pin out of housing with pin punch (Fig. 118). Then remove old reverse pin.

(c) Install new reverse pin and secure it with roll pin. Then install and tighten access plug to 19 N·m (14 ft. lbs.) torque.

(14) Clean sealing surfaces of adapter or extension housing and intermediate plate with wax and grease remover. Then wipe dry with a clean cloth.

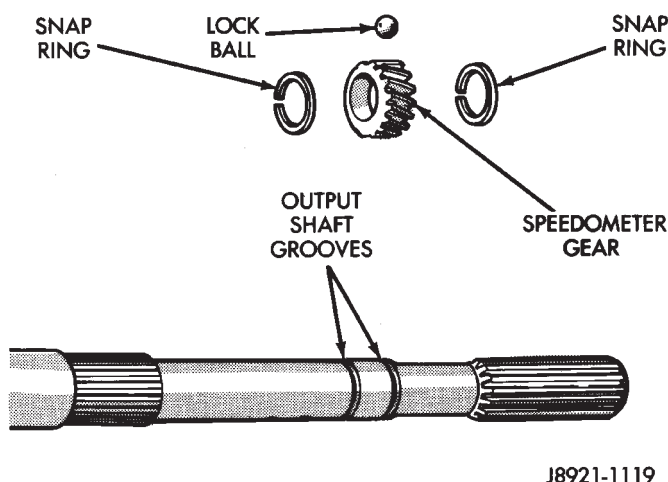


Fig. 115 Speedometer Gear Installation (2WD Models)

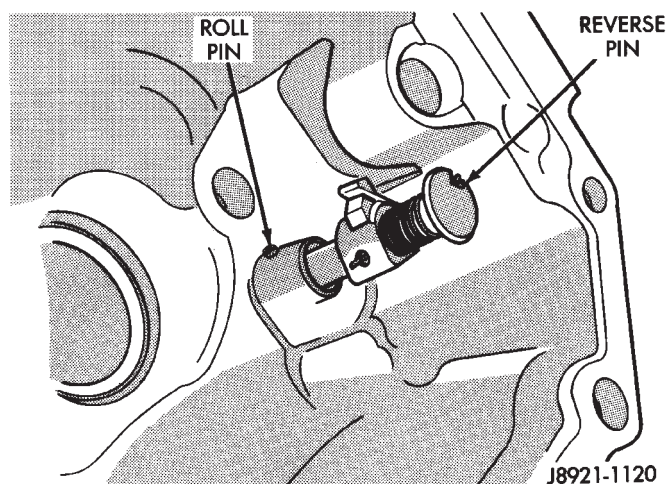


Fig. 116 Reverse Pin Position

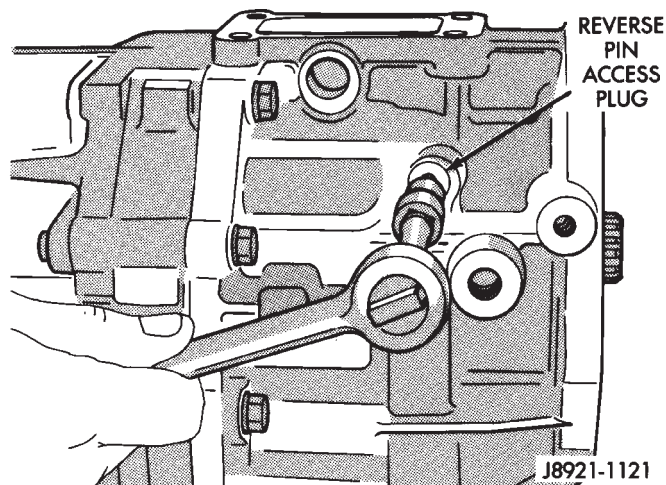


Fig. 117 Access Plug Removal/Installation

(15) Apply 3 mm (1/8 in.) wide bead of Mopar Gasket Maker to sealing surface of adapter or extension housing. Keep sealer bead inside bolt holes as shown in Figure 111.

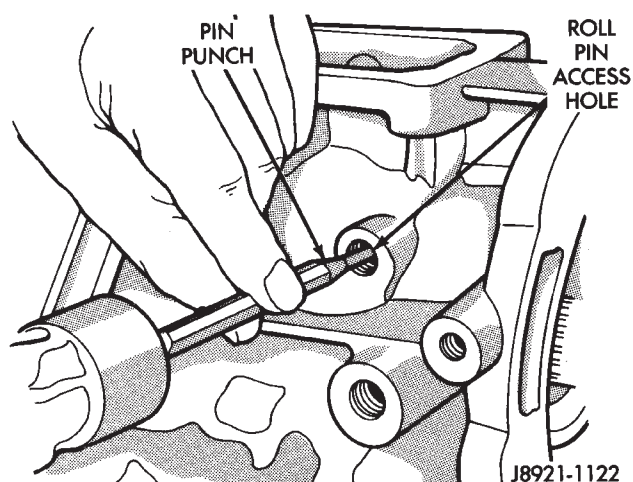


Fig. 118 Roll Pin Removal/Installation

(16) Align and install adapter or extension housing on intermediate plate (Fig. 119). Be sure housing is seated on intermediate plate dowel pins.

(17) Coat threads of housing attaching bolts with silicone sealer. Then install and tighten bolts to 37 N·m (27 ft. lbs.) torque.

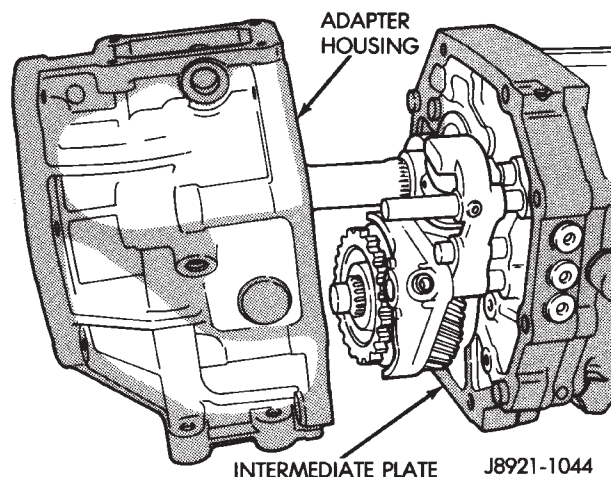


Fig. 119 Adapter/Extension Housing Installation

(18) Install detent ball (Fig. 120).

(19) Install detent spring (Fig. 121).

(20) Install detent access plug (Fig. 122). Tighten plug to 19 N·m (14 ft. lbs.) torque.

(21) Lubricate shift arm shaft and install it in adapter housing (Fig. 123).

(22) Position shift arm in adapter housing (Fig. 124). Be sure arm is engaged in shift rails.

(23) Align shift arm with shaft and push shaft into arm.

(24) Rotate shift arm shaft until set screw holes in shaft and arm are aligned.

(25) Install and tighten shift arm set screw to 38 N·m (28 ft. lbs.) torque (Fig. 125).

(26) Install and tighten restrictor pins to 19 N·m (14 ft. lbs.) torque (Fig. 125).

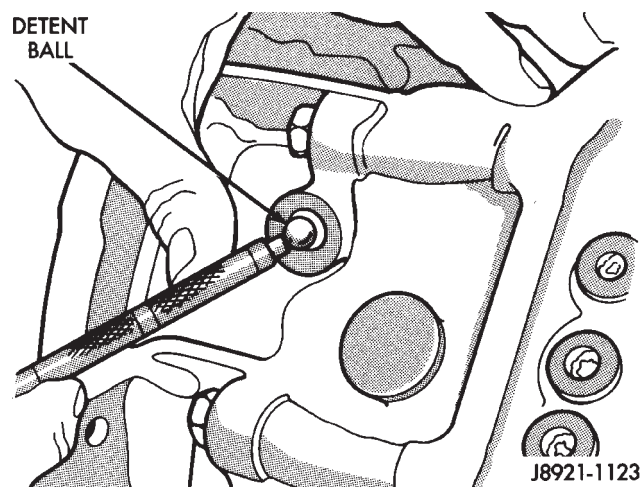


Fig. 120 Installing Detent Ball

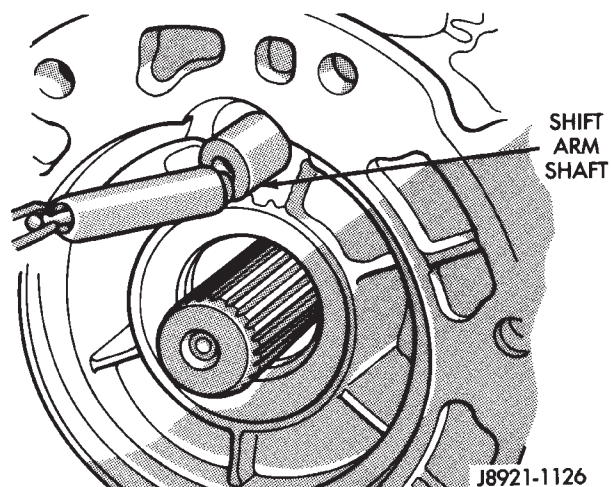


Fig. 123 Installing Shift Arm Shaft

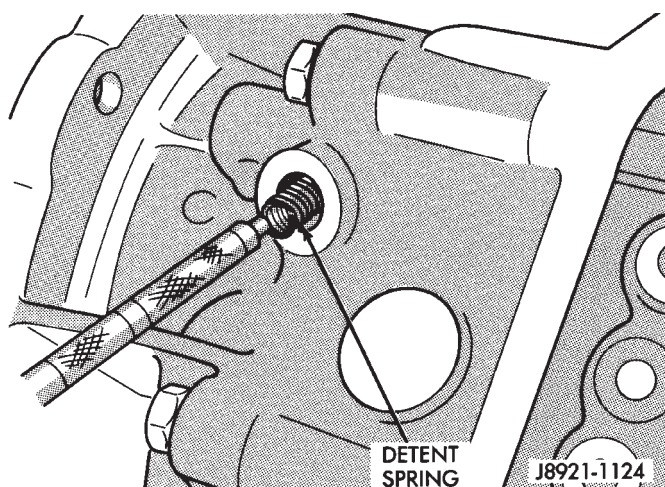


Fig. 121 Installing Detent Spring

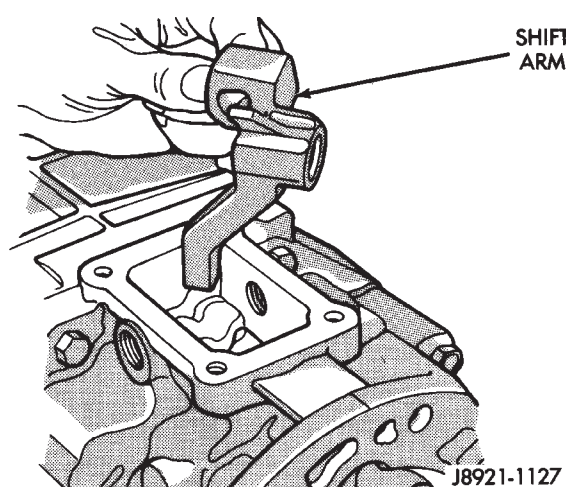


Fig. 124 Shift Arm Installation

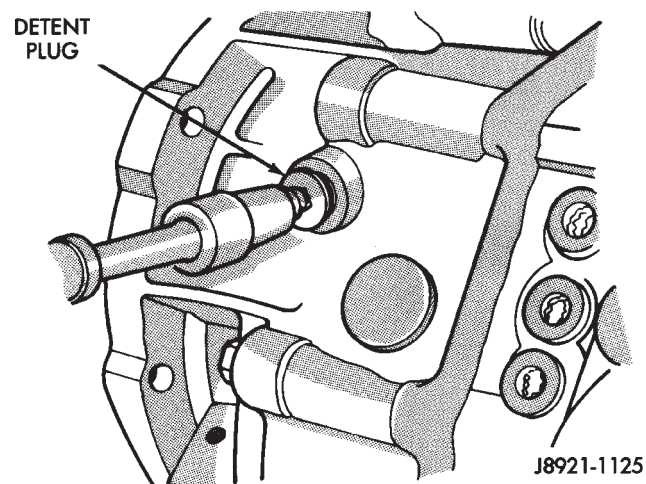


Fig. 122 Installing Detent Access Plug

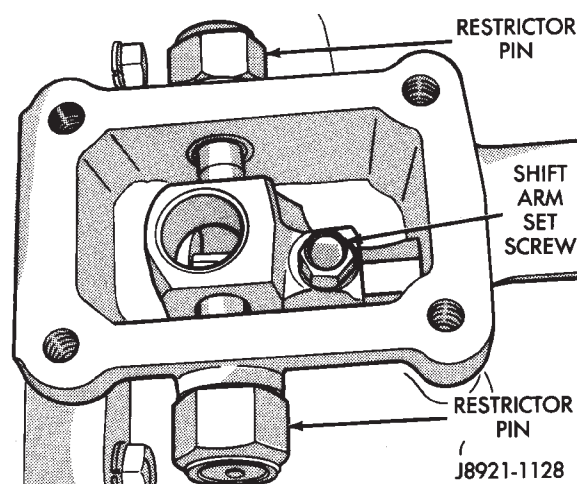


Fig. 125 Set Screw And Restrictor Pin Installation

(27) Install and tighten shift arm shaft access plug to 19 N·m (14 ft. lbs.) torque (Fig. 126).

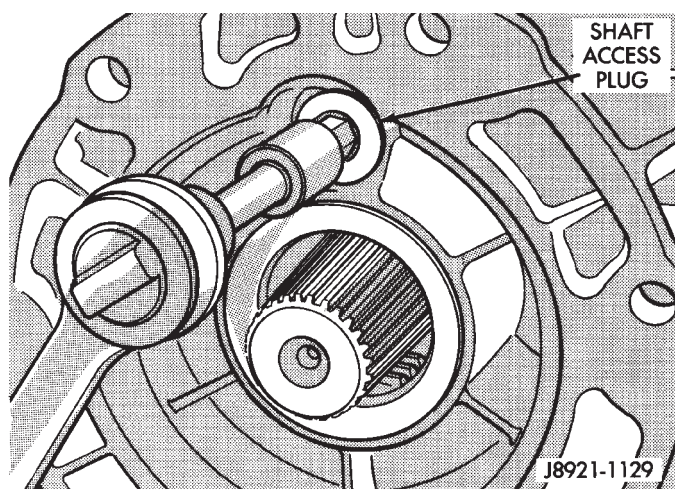


Fig. 126 Access Plug Installation

(28) Position new shift tower gasket on adapter housing (Fig. 127).

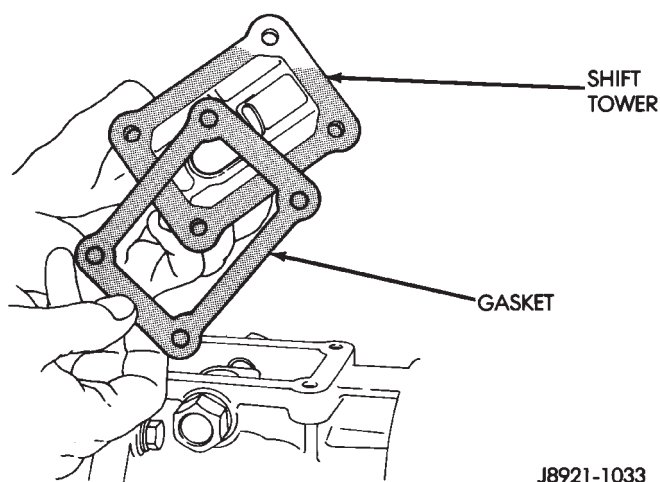


Fig. 127 Shift Tower Gasket Installation

(29) Install shift tower (Fig. 128). Tighten tower attaching bolts to 18 N·m (13 ft. lbs.) torque.

(30) Install new gasket on backup light switch and install switch. Tighten switch to 37 N·m (27 ft. lbs.) torque.

(31) Install new washer on drain plug. Then install and tighten plug to 37 N·m (27 ft. lbs.) torque.

(32) If transmission will be filled with gear lubricant before installation, place transmission in a level

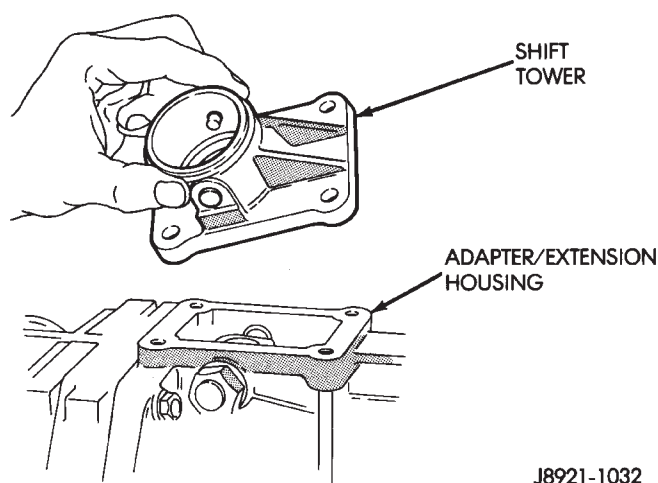


Fig. 128 Shift Tower Installation

position. Then fill with Mopar 75W-90, grade GL-5 gear lubricant. Correct fill level is to bottom edge of fill plug hole.

(33) Install new washer on fill plug. Then install and tighten plug to 37 N·m (27 ft. lbs.) torque.

(34) Install clutch housing and release bearing components.

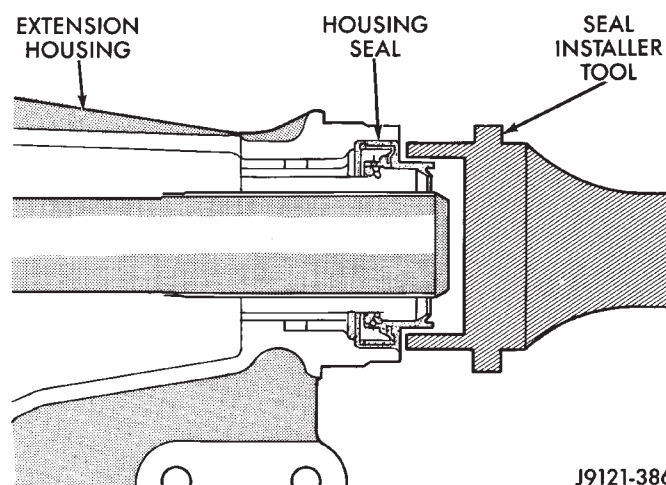


Fig. 129 Installing Extension Housing Seal—2WD Models

(35) On 2-wheel drive models, install new seal in extension housing with suitable size installer tool (Fig. 129). Lubricate seal lips with petroleum jelly before installation.

(36) On 2-wheel drive models, install speedometer driven gear (if removed), and vehicle speed sensor.