# Muncie

## FIVE-SPEED MANUAL TRANSAXLE

GM Product Service Training

17004.04-1

# Muncie 5-Speed Manual Transaxle

## Foreword

While this booklet will serve as an excellent review of the extensive program in the training center session, it is not intented to substitute for the various service manuals normally used on the job. The range of specifications and the variation in procedures between divisions and models require that the division service publications be referred to, as necessary, when performing these operations.

All information contained in this booklet is based on the latest data available at the time of publication approval. The right is reserved to make product or publication changes, at any time, without notice. This booklet, or any portion thereof, may not be reproduced without written consent of the GM Product Service Training, General Motors Corporation.

# Table of Contents

# 1. Description

## Specifications

The Muncie Getrag 282 (MG282) transaxle is a 5-speed unit with these applications:

- 1986-1987 Pontiac "P" with 2.8L PFI (L44) P/N 14080502 (RPO MG2)
- 1987 Chevrolet and Pontiac "A" with 2.8L PFI (LB6) P/N 14092007 (RPO MG2)
- 1987 Chevrolet, Oldsmobile and Cadillac "J" with 2.8L PFI (LB6) P/N 14092008 (RPO MG2)
- 1987 Chevrolet "L" with 2.8L PFI (LB6) P/N 14092009 (RPO MG2)
- 1987 Pontiac and Buick "J" with 2.0L PFI/Turbo (LT3) P/N 14092047 (RPO MG1)

This transaxle was designed for Chevrolet (the manual transmission platform division) by Getrag of West Germany. It is manufactured at the Hydra-matic-operated manual transmission plant, Muncie, Indiana.

**The design specifications include:**

- The unit must have the same size as Muncie's 4-speed transaxle (FX 125 and 170), (Figure 1-1).
- The unit must have high torque capability.
- The unit must have five synchronized forward speeds.
- The unit must meet "world class" standards of performance and reliability.

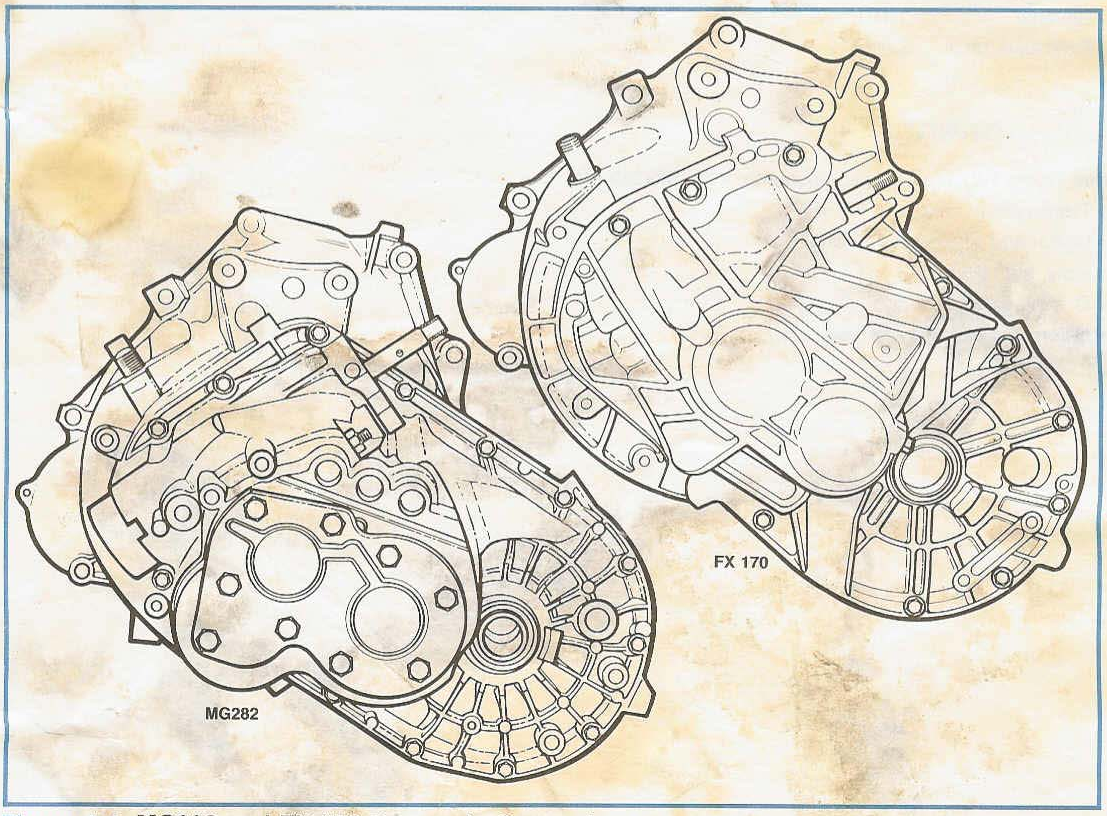



**Figure 1-1, MG282 and FX 170 Transaxle Comparison.**

# 1. Description

**The MG282's features are:**

- Rated input torque capacity of 170 ft. lbs. (future capacity of 200 ft. lbs.).
- Center distance of 76 mm (same as FX 125 and 170).
- Dry weight of 88 lbs.
- Case material made of aluminum.
- All forward speeds are synchronized with constant-mesh gears.
- Input and output shafts are supported by ball and roller bearings.
- Speed gears are supported by roller bearings.
- Oil capacity is 2 quarts ("A and P" carlines) or 5 pints ("J, L and N" carlines). (Note: the FX 125/170 transaxle has a 3-quart oil capacity.)
- Gear ratios as follows:

| | |
|---|---|
| 1st speed | 3.50 to 1 |
| 2nd speed | 2.05 to 1 on MG2, 2.19 to 1 on MG1 |
| 3rd speed | 1.38 to 1 |
| 4th speed | .94 to 1 |
| 5th speed | .72 to 1 |
| Reverse | 3.41 to 1 |
| Final drive ratio | 3.61 to 1 |

## Components

See Figure 1-2. The basic components of the MG282 are:

- Transmission case
- Clutch and differential housing
- Input shaft assembly
- Output shaft assembly
- Differential and ring gear assembly

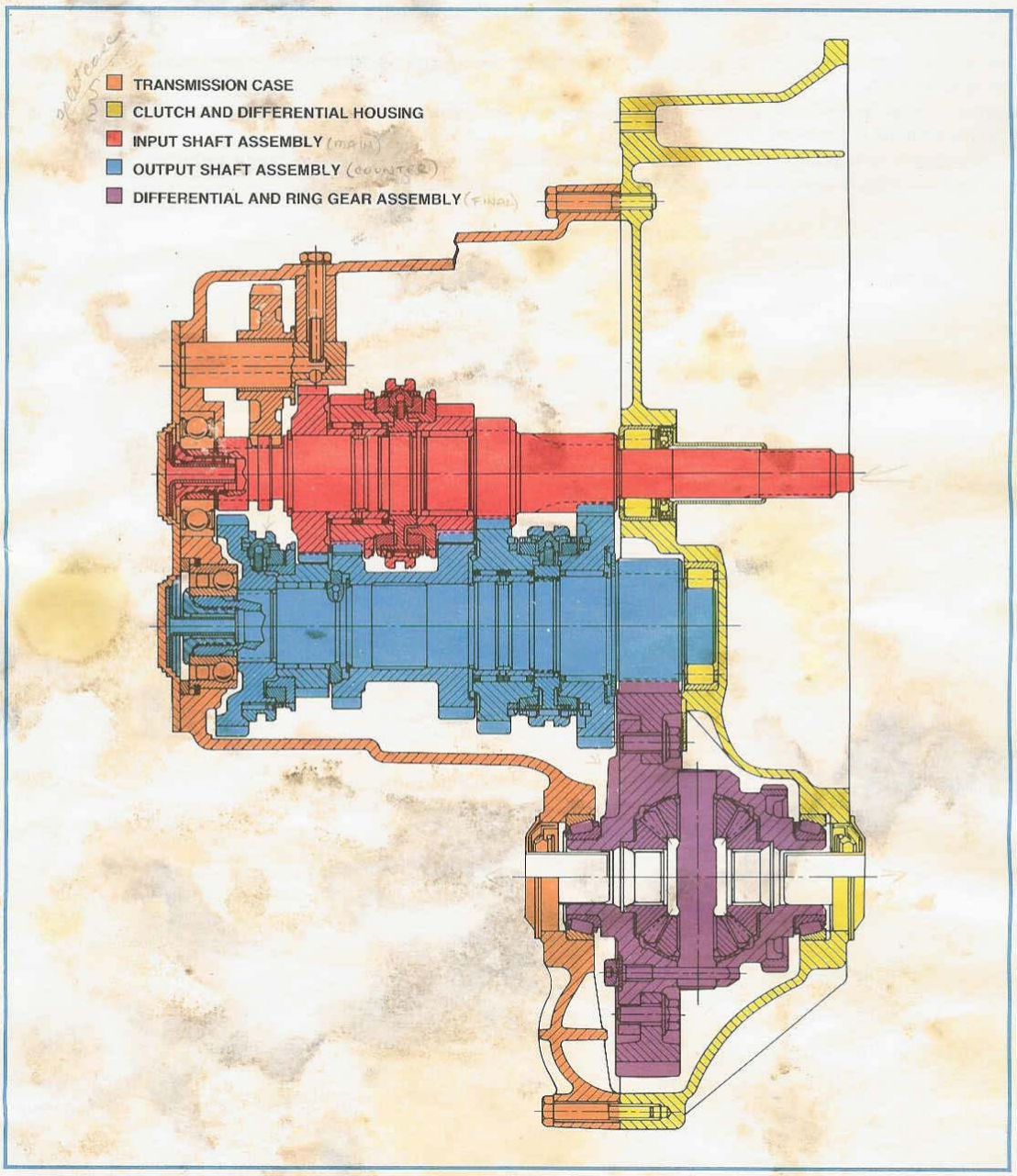



**Figure 1-2, MG282 Basic Components.**

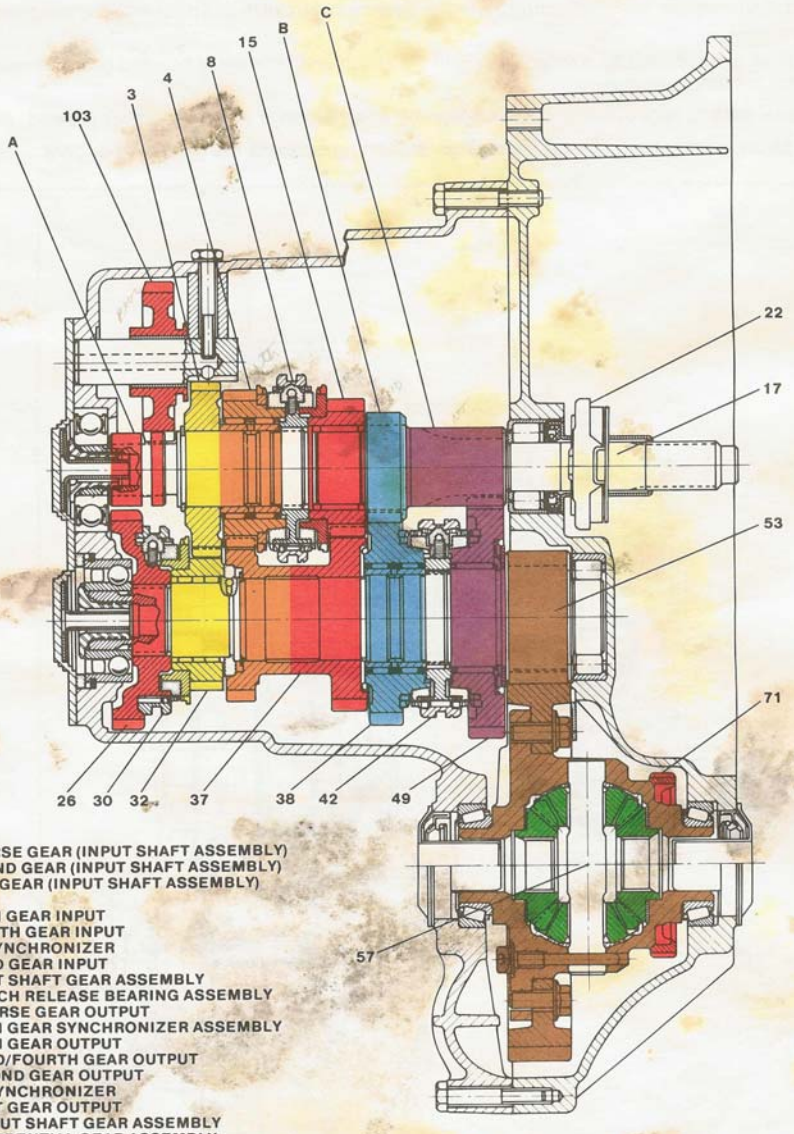
# 1. Description

Gearing provides for five synchronized forward speeds, one reverse speed, a final drive with differential output, and speedometer drive (Figure 1-3).

The input and output gear clusters are "nested" very close together, requiring extremely tight tolerances of shafts, gears, and synchronizers.

In order to meet "world class" standards of operating noise level, the gear teeth are formed in a two-step process to guarantee control of backlash.

The first step is the hobbing of the gear teeth before hardening. The second step involves shaving the final tooth profiles, after the hardening is completed, a process known as "hard finishing."




A. REVERSE GEAR (INPUT SHAFT ASSEMBLY)
B. SECOND GEAR (INPUT SHAFT ASSEMBLY)
C. FIRST GEAR (INPUT SHAFT ASSEMBLY)

3. FIFTH GEAR INPUT
4. FOURTH GEAR INPUT
8. 3-4 SYNCHRONIZER
15. THIRD GEAR INPUT
17. INPUT SHAFT GEAR ASSEMBLY
22. CLUTCH RELEASE BEARING ASSEMBLY
26. REVERSE GEAR OUTPUT
30. FIFTH GEAR SYNCHRONIZER ASSEMBLY
32. FIFTH GEAR OUTPUT
37. THIRD/FOURTH GEAR OUTPUT
38. SECOND GEAR OUTPUT
42. 1-2 SYNCHRONIZER
49. FIRST GEAR OUTPUT
53. OUTPUT SHAFT GEAR ASSEMBLY
57. DIFFERENTIAL GEAR ASSEMBLY
71. SPEEDOMETER DRIVE GEAR
103. REVERSE IDLER GEAR

Figure 1-3, **Cross Section View – Muncie (5-Speed) Transaxle.**

## Component Support

See Figure 1-4. The input shaft is supported by a roller bearing in the clutch and differential housing and a ball bearing in the transmission case.

The output shaft is supported by a roller bearing in the clutch and differential housing and a combination ball-and-roller bearing in the transmission case.

The differential case is supported by opposed tapered roller bearings which are under preload.

The speed gears are supported by roller bearings. A bushing supports the reverse idler gear.

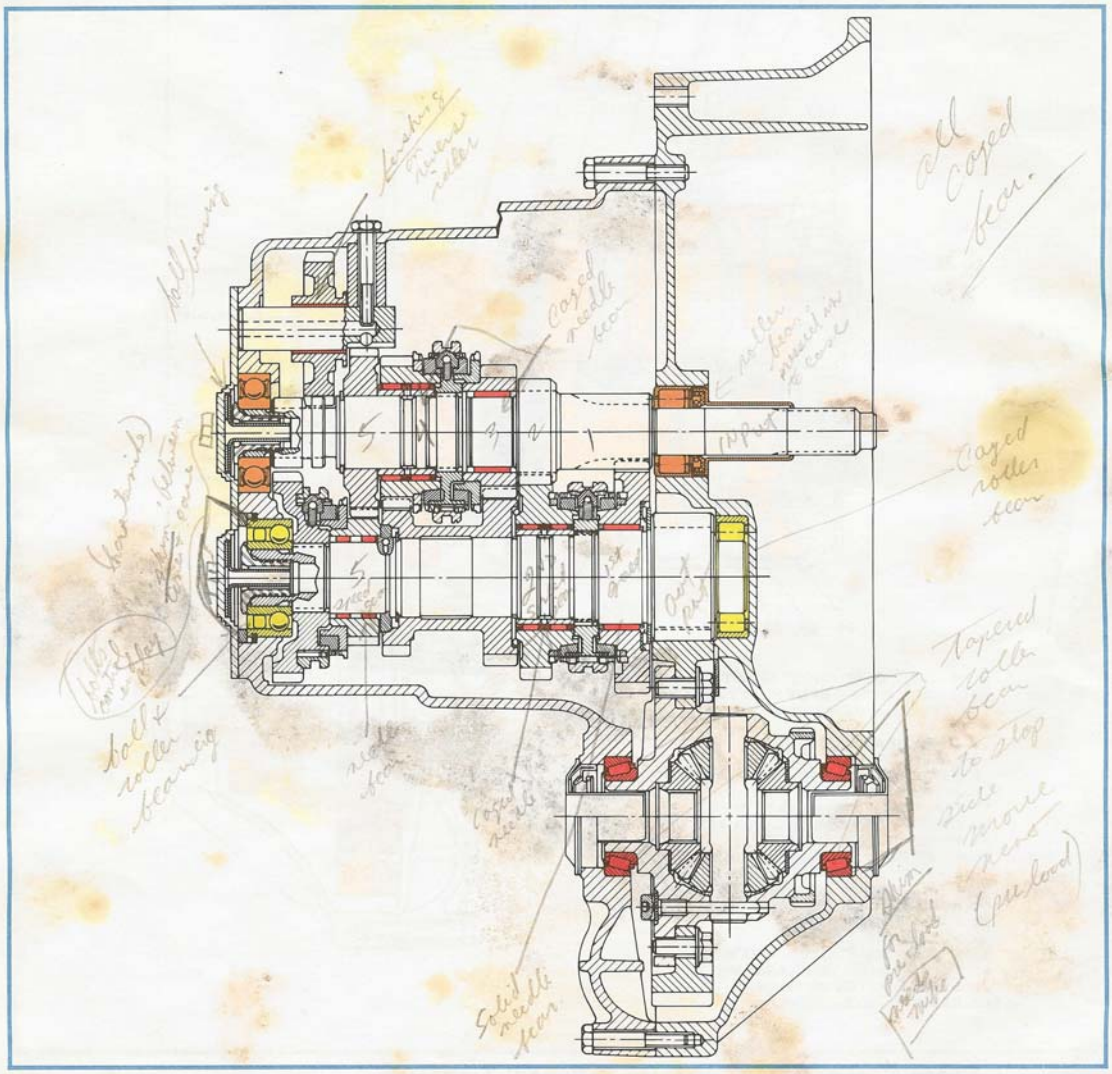


**Figure 1-4, Bearings.**

## Component Lubrication and Cooling

The oil level of the MG282 is responsible for the lubrication system operating as follows (Figure 1-5):

- The input shaft parts dip in lube oil and, due to centrifugal force, throw oil onto the outside surfaces of the output shaft gears.
- The output shaft parts dip in lube oil and, like the input shaft parts, throw oil. This oil is thrown on the input shaft and differential parts.
- The differential is partially submersed in lube oil so its parts are bathed with lubricant. The ring gear throws oil to a deflector, which channels oil to be poured on output shaft parts.

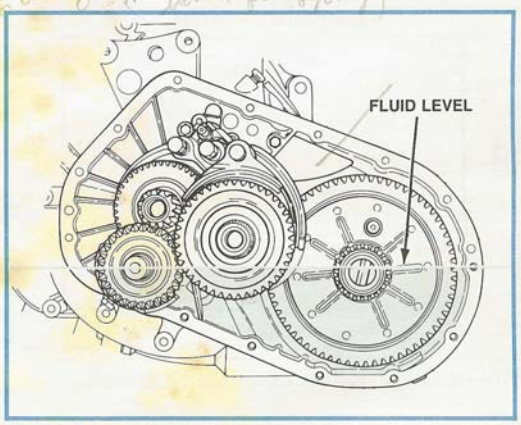



Figure 1-5, **Oil Level.**

- Whatever oil is thrown against the wall of the transmission case next to the input shaft is caught by a trough (Figure 1-6). This oil flows to the end plate, where it is guided to rifle-drilled holes in the input and output shafts.

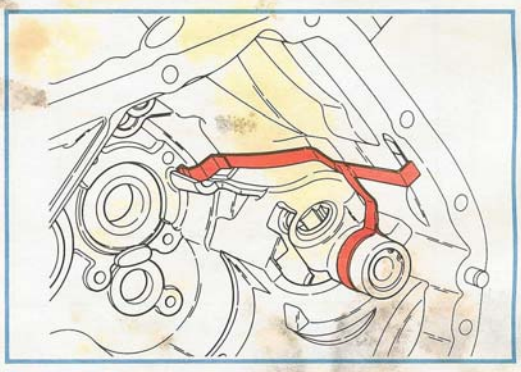


Figure 1-6, **Lube Trough.**

- Holes intersecting these rifle-drilled passages allow for lubrication of all speed gears and synchronizer parts by centrifugal force (Figure 1-7).

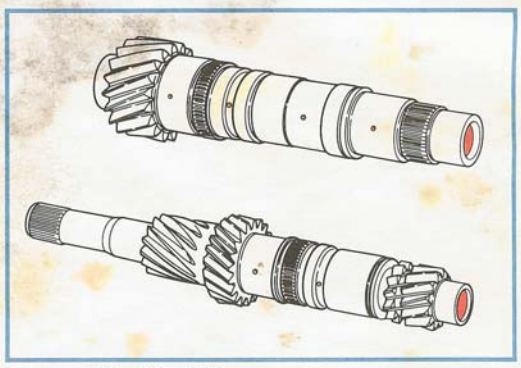


Figure 1-7, **Shaft Passages.**

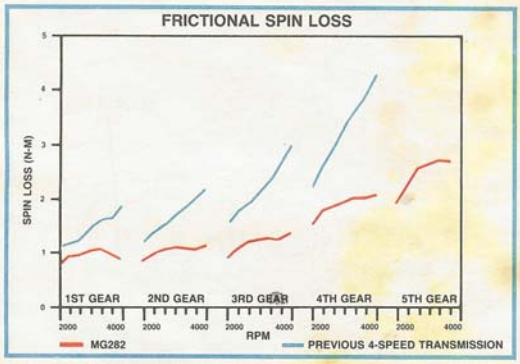



Figure 1-8, **Friction Loss Comparison.**

The result of the careful design of the lube system is:

- Less transmission friction, allowing more power to reach the drive wheels (see Figure 1-8).

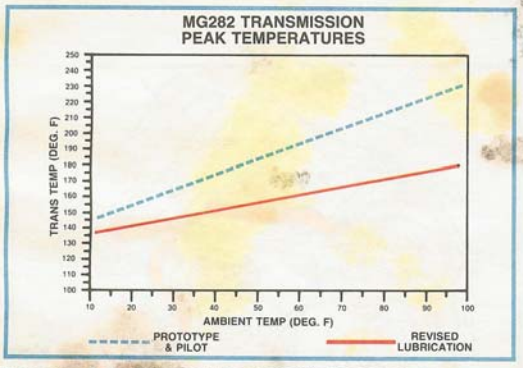



Figure 1-9, **Transmission Temperature Comparison.**

- Lower transmission temperature, which promotes longer component life (see Figure 1-9).

## Shift Systems

The MG282 can be shifted into its five forward (and one reverse) speeds using:

- The clutch system
- Shift control system
- Shift shaft assembly
- Shift rail assemblies
- Synchronizer assemblies

## Clutch System

### PRINCIPAL COMPONENTS

See Figure 1-10. As with other manual transmissions, the MG282's clutch system consists of:

- Driving members
- Driven members
- Operating members

Driving members consist of the:

- Flywheel, with no pilot bearing or bushing to support the transaxle input shaft.
- Pressure plate, with 1281 pounds of total spring load provided by Belleville-type springs.

The driven member, the clutch disc, is supplied by Valeo. Its dimensions are:

- 9.125-inch outside diameter by 6.125-inch inside diameter.
- 0.300-inch thickness of riveted non-asbestos facing material.

Engagement cushion is by the driven plate wave spoke spring method.

Torsional damping uses coil springs with non-metal friction control.

The operating members include:

- The clutch release bearing
- The hydraulic release system

The release bearing is of the self-centering design. It is an angular contact ball bearing which is pre-packed and sealed.

The clutch release system is operated by hydraulic pressure and consists of the clutch pedal, clutch master cylinder, clutch pipe and hose assembly, clutch slave cylinder, clutch fork lever, and transmission clutch shaft-and-fork assembly. The hydraulic clutch system locates the clutch pedal and provides automatic clutch adjustment. No adjustment of clutch linkage or pedal position is required.

When pressure is applied to the clutch pedal to release the clutch, hydraulic pressure is exerted against the outer end of the clutch fork lever. As the fork pivots on its shaft, the inner end pushes against the release bearing. The bearing then pushes against the diaphragm spring levers in the pressure plate assembly, thereby releasing the clutch.

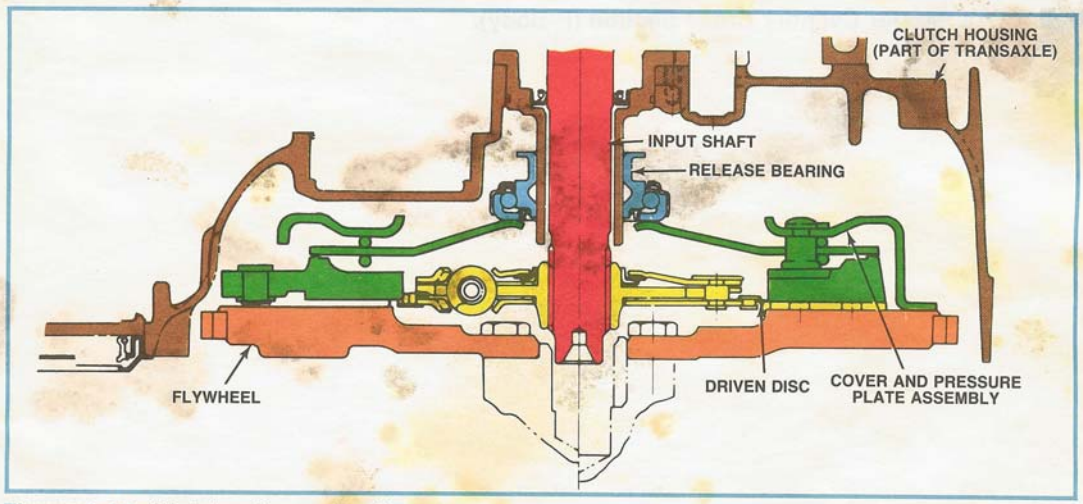



**Figure 1-10, Clutch – Cross Section.**

## MASTER CYLINDER

See Figure 1-11. The fluid reservoir is an integral part of the cylinder. The operating principle is as follows:

When pressure is applied to the pedal, the push rod contacts the plunger and pushes it up the bore of the cylinder. On P-body, in the first 1/32 in. of movement, the center valve seal closes the port to the fluid tank. As the plunger continues to move up the bore of the cylinder, the fluid is forced through the outlet line to the slave cylinder mounted on the clutch housing.

On the return stroke, the plunger moves back as a result of the return pressure of the clutch. Fluid returns to the master cylinder. On P-body, the final movement of the plunger lifts the valve seal off the seat, allowing an unrestricted flow of fluid between system and tank.

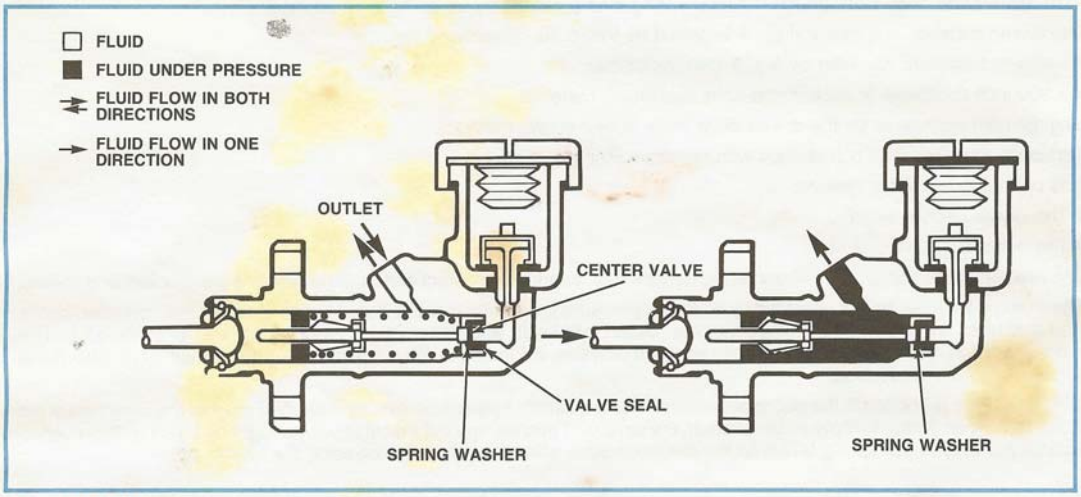



**Figure 1-11, Master Cylinder Cross Section (P-Body).**

## SLAVE CYLINDER

The cylinder is made with a threaded inlet port which is connected to the master cylinder by a length of pipe (Figure 1-12).

As fluid is pushed along the pipe from the master cylinder to the slave cylinder, this in turn forces the slave cylinder piston outward. A push rod connects the slave cylinder and the clutch operating lever.

## HYDRAULIC CLUTCH FLUID

**— CAUTION —**

**Do not use mineral or parafin-base oils in the clutch hydraulic system. These fluids will damage the rubber parts in the cylinders.**

**When adding fluid to or refilling the system after service operations, use GM Delco Supreme No. 11 brake fluid or an equivalent fluid that meets DOT 3 specifications.**

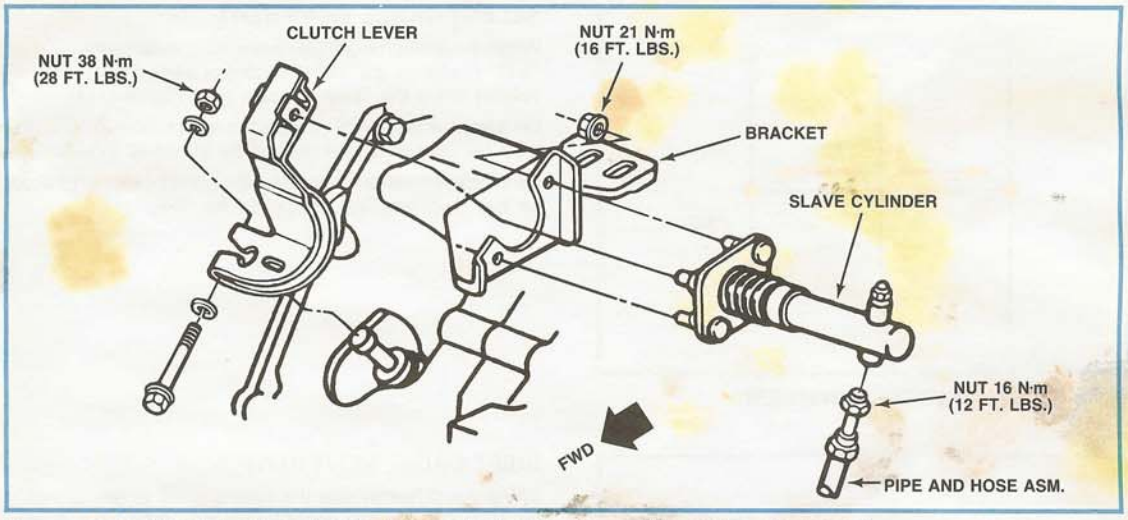



**Figure 1-12, Clutch Slave Cylinder and Clutch Lever Mounting (P-Body).**

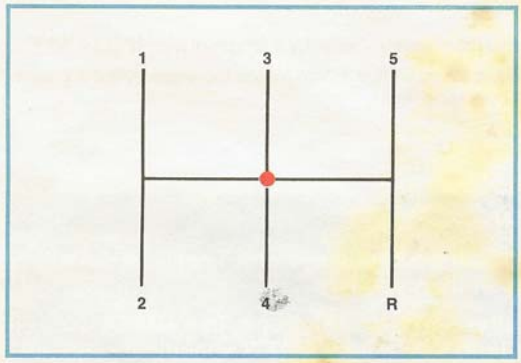



Figure 1-13, **Control Lever in Neutral.**

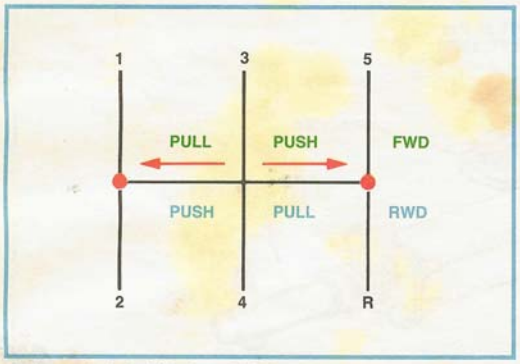



Figure 1-14, **"Select" Movement.**

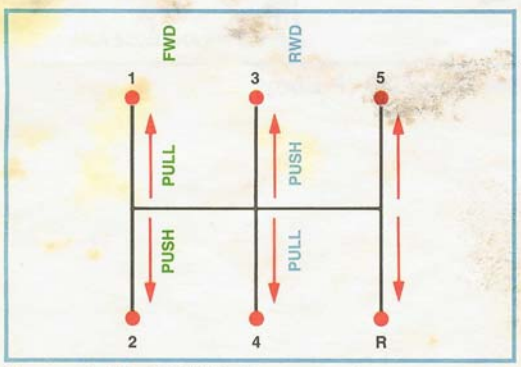



Figure 1-15, **"Shift" Movement.**

## Shift Control System

See Figures 1-16 through 1-19. The shift control system used on vehicles equipped with the MG282 transaxle consists of:

- A shift control assembly inside the passenger compartment.
- A "select" and a "shift" cable assembly.
- Transaxle external linkage to move the shift shaft.

### SHIFT CONTROL ASSEMBLY AND CABLES

The driver moves the MG282 shift control lever in a pattern that follows (Figure 1-13).

In neutral, the control lever is pushed to the "3-4" position by internal transaxle springs which position the shift shaft.

### SELECT CABLE MOVEMENT

When the driver moves the shift control lever to the "1-2" or "5-R" positions, parts of the control assembly (colored yellow) move the "select" cable (see Figure 1-14).

On a front-wheel-drive vehicle, the select cable is pulled for the "1-2" position, and pushed for the "5-R" position.

On a rear-wheel-drive vehicle, the select cable is pushed for the "1-2" position and pulled for "5-R."

### SHIFT CABLE MOVEMENT

When the driver moves the control lever to any speed position, parts of the control assembly (colored orange) move the "shift" cable (see Figure 1-15). On a front-wheel-drive vehicle, the shift cable is pulled for 1st, 3rd, and 5th speed selection, and pushed for 2nd, 4th and Reverse speeds.

On a rear-wheel-drive vehicle, the shift cable is pushed for 1st, 3rd, and 5th speed selection, and pulled for 2nd, 4th, and Reverse speeds.

The following chart summarizes the relationship between shift control lever movement and cable movement, in order of occurance, for a front-wheel-drive car:

| SHIFT LEVER MOVEMENT | PULL SELECT | PUSH SELECT | PULL SHIFT | PUSH SHIFT |
|---|---|---|---|---|
| Neutral to 1st speed | 1 | | 2 | |
| 1st to 2nd speed | | | | 1 |
| 2nd to 3rd speed | | 2 | 1 | 3 |
| 3rd to 4th speed | | | | 1 |
| 4th to 5th speed | | 2 | 1 | 3 |
| Neutral to Reverse | | 1 | | 2 |

For rear-wheel-drive, reverse the movements for the cables (Example: push select for pull select).

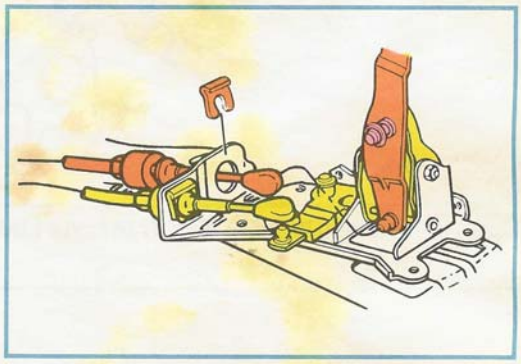


Figure 1-16, **Front-Wheel-Drive Shift Control Assembly.**

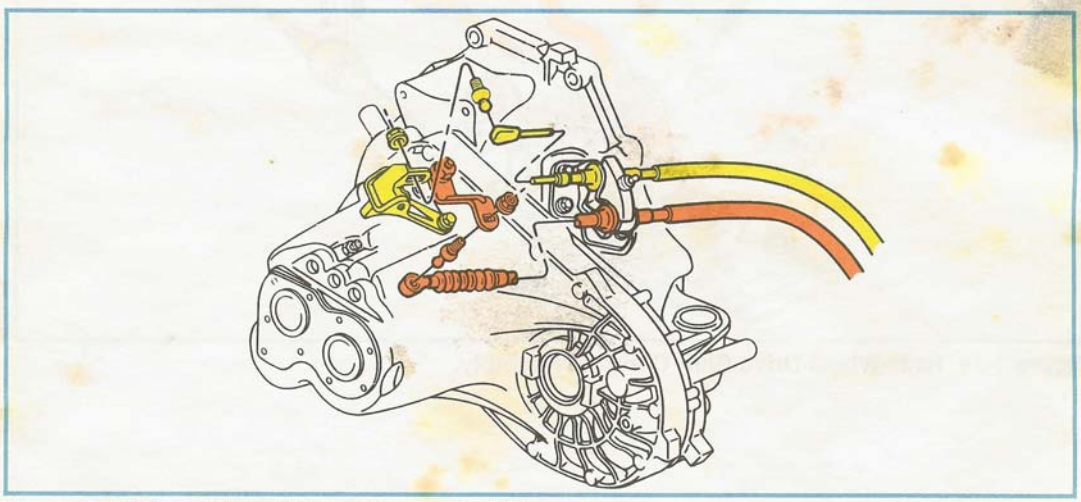


Figure 1-17, **Front-Wheel-Drive Transaxle Linkage.**

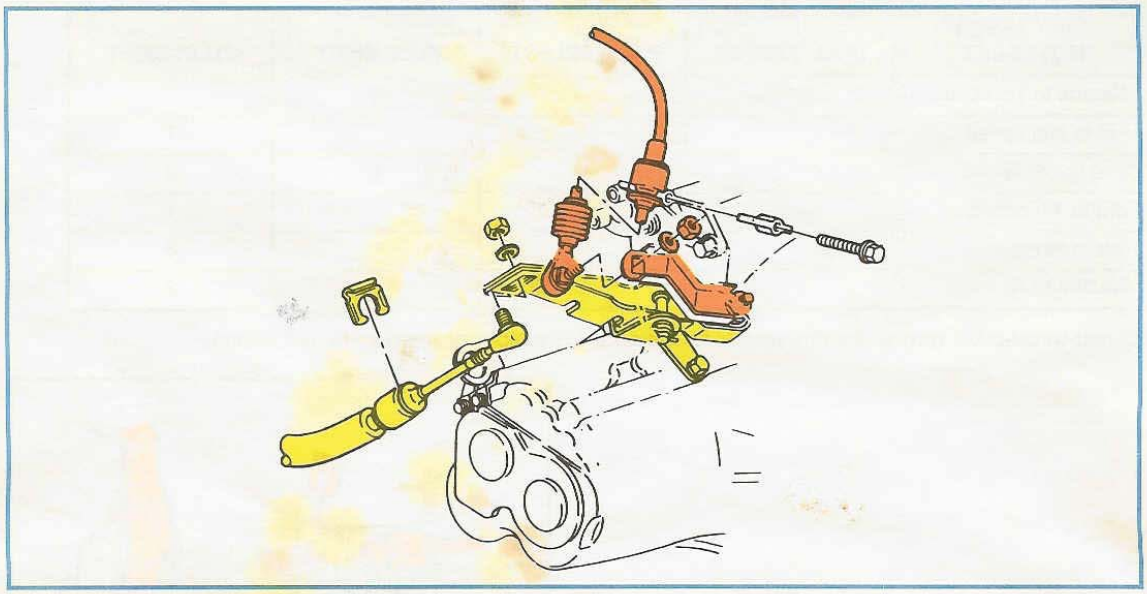


Figure 1-18, Rear-Wheel-Drive Transaxle Linkage.

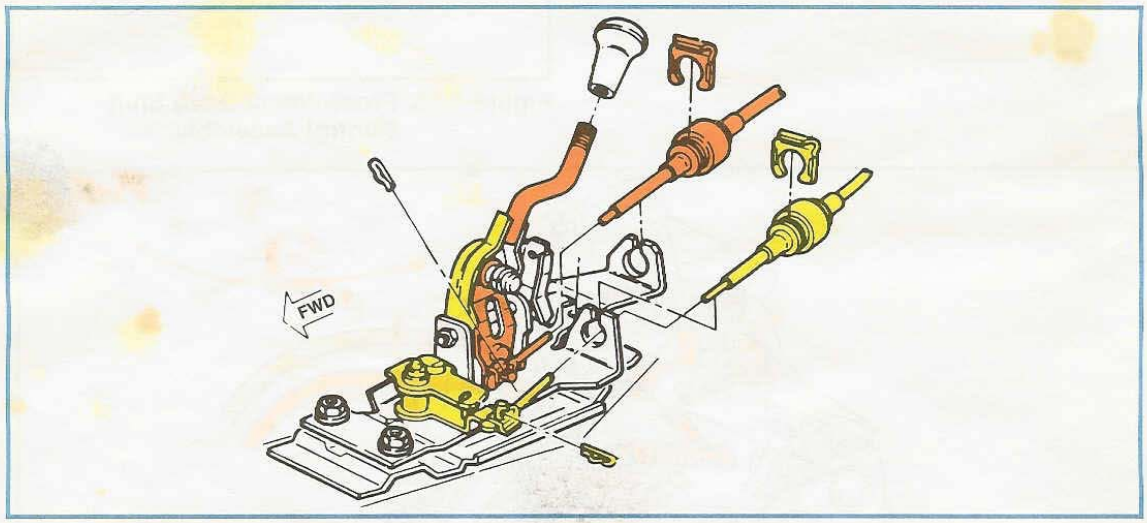



Figure 1-19, Rear-Wheel-Drive Shift Control Assembly.

## EXTERNAL TRANSAXLE LINKAGE

The movement of the select cable causes the select lever on the outside of the transaxle to pivot (see Figure 1-20).

As it does so, the select lever pulls up or pushes down on the shift shaft through a collar.

To move from the "3-4" position to the "1-2" position, the lever pushes down the shift shaft.

To move from the "3-4" position to the "5-R" position, the lever pulls the shift shaft up. This movement is the same on front-wheel-drive and rear-wheel-drive vehicles.

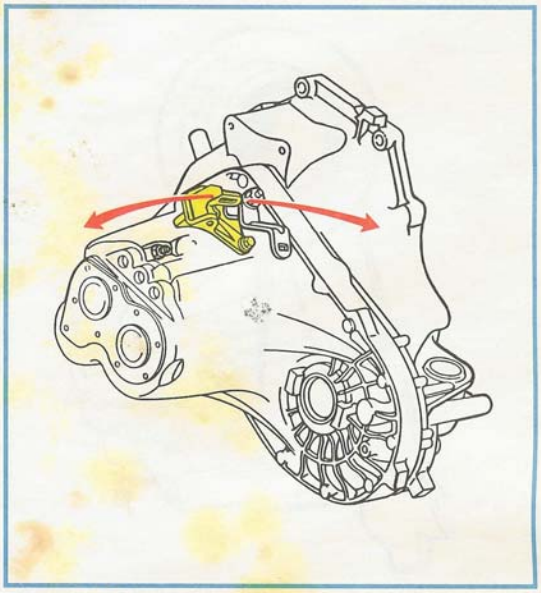


**Figure 1-20, Select Lever Movement (FWD Linkage Shown).**

The movement of the shift cable causes the shift lever on the outside of the transaxle to pivot (see Figure 1-21).

As it does so, the shift lever rotates the shift shaft either in a clockwise or counterclockwise direction. It is fastened directly to the shift shaft.

To move to the 1st, 3rd, or 5th speed position, the shift lever rotates the shaft counterclockwise.

To move to the 2nd, 4th, or Reverse position, the shift lever rotates the shaft clockwise.

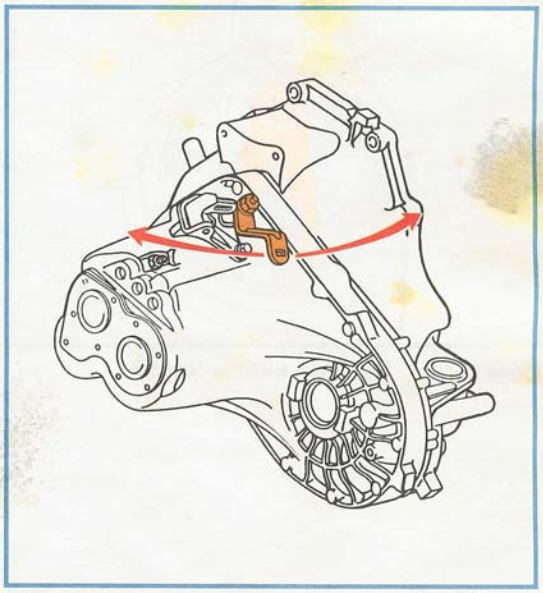


**Figure 1-21, Shift Lever Movement (FWD Linkage Shown).**

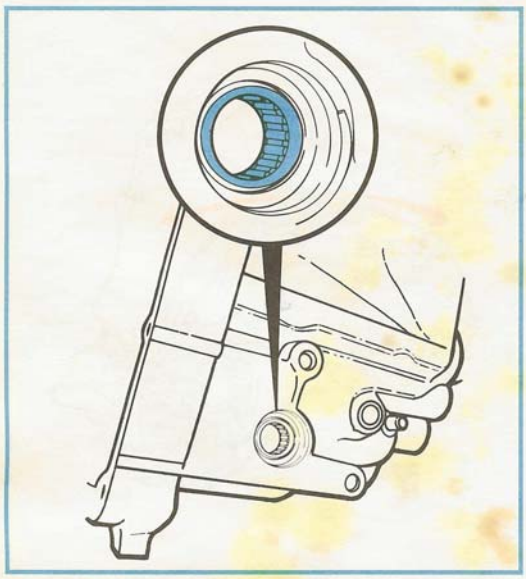


Figure 1-22, **Shift Shaft Bearing and Seal.**

## Shift Shaft Assembly

The external movements of the previously discussed external levers for the shift shaft cause actions and reactions inside the transaxle. The shift shaft can move in two ways:

- Up and down (it slides)
- Clockwise and counterclockwise (it rotates)

The shift shaft is supported by a roller bearing at the top of the transmission case, protected from outside elements by a seal (Figure 1-22).

The bottom of the shift shaft is supported as follows:

- The transmission case supports a detent lever by way of a Teflon-coated bronze bushing.

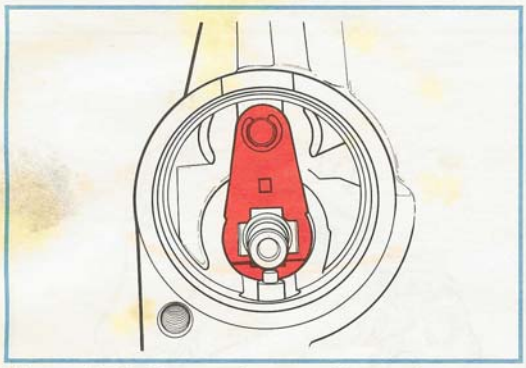


Figure 1-23, **Detent Lever – Neutral.**

- The detent lever has channels on its inside bore which allow rollers (held by pins on the shift shaft) to ride (Figure 1-23).
- The rollers support the shift shaft directly and allow it to slide up and down with very little friction.

As the shift shaft rotates clockwise, the detent lever rotates with it, and the spring tension behind a sliding sleeve must be overcome (Figure 1-24). This provides a feeling of shift detent for feedback to the driver that the shift has occurred.

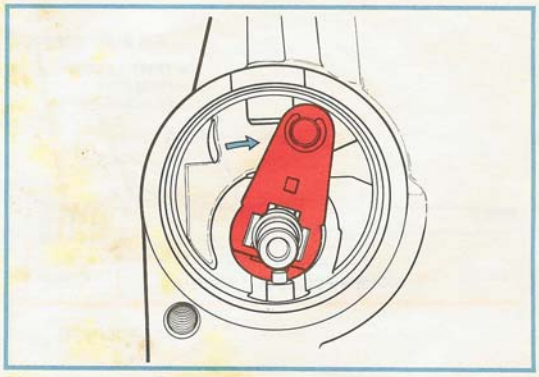


Figure 1-24, **Detent Lever – CW Stop.**

The same is true when the shift shaft rotates counter-clockwise. The detent lever again produces a "feel" for shift control lever movement (Figure 1-25).

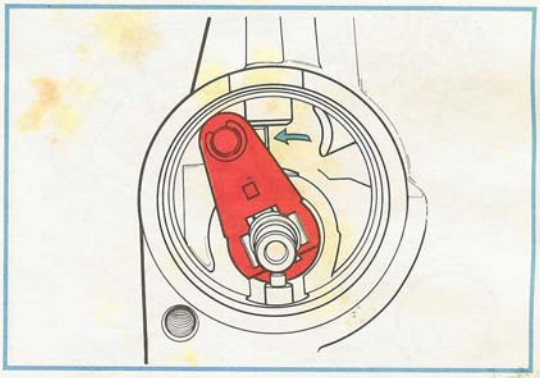


Figure 1-25, **Detent Lever – CCW Stop.**

The shift shaft has an internal shift lever located by a roll pin (Figure 1-26). This lever aligns with the shift notches on the shift rails, and pushes them right or left to engage the snychronizer sleeves with the speed gears as it responds to shift cable movement.

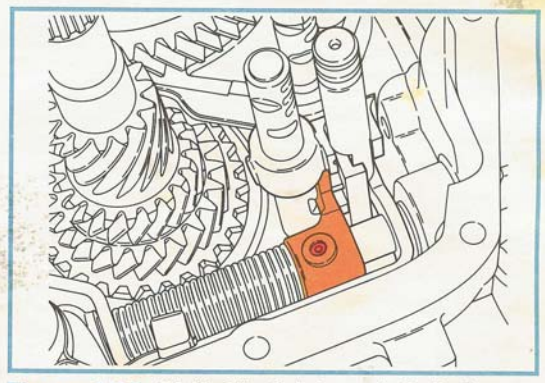


Figure 1-26, **Shift Shaft Internal Shift Lever.**

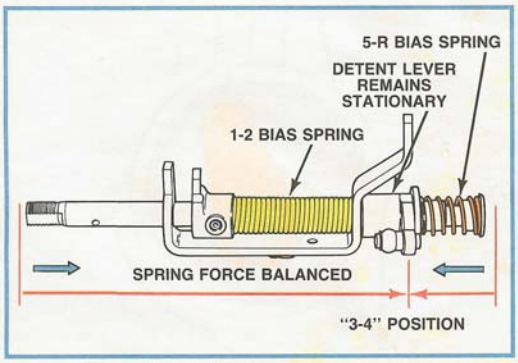



Figure 1-27, **Bias Springs.**

The internal shift lever also must align with only one shift rail notch at a time. Select cable movement makes the lever do this. There is control of the position of the internal shift lever by using two springs (Figure 1-27).

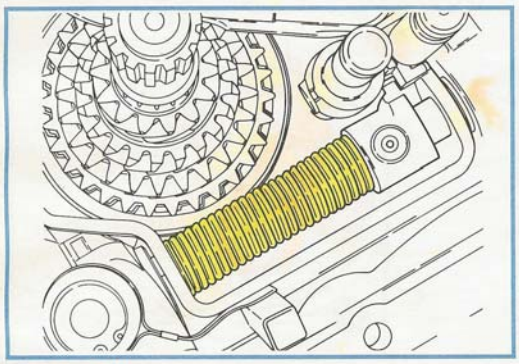


Figure 1-28, **"1-2" Bias Spring.**

The "1-2" bias spring (Figure 1-28) is located between the reverse lever and the internal shift lever. It pushes the shift shaft up.

The "5-R" bias spring (Figure 1-29) is located between a spring seat resting against the other side of the detent lever and another seat fastened to the end of the shift shaft with a screw. It pushes the shift shaft down. When the "1-2" and "5-R" bias springs force balance, they locate the shift shaft internal shift lever at the notch of the 3-4 shift rail.

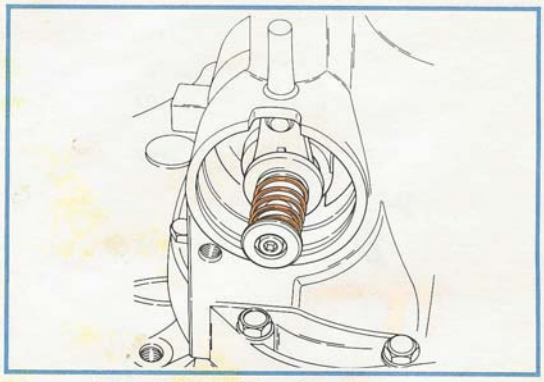


Figure 1-29, "5-R" Bias Spring.

So, to move the shift control lever from the "3-4" position to the "1-2" position, the driver must push against the "1-2" bias spring tension. To shift from the "3-4" to the "5-R" position, the driver works against the tension of the "5-R" bias spring (Figure 1-30).

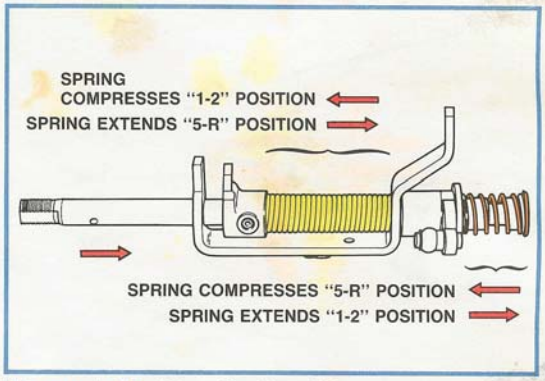
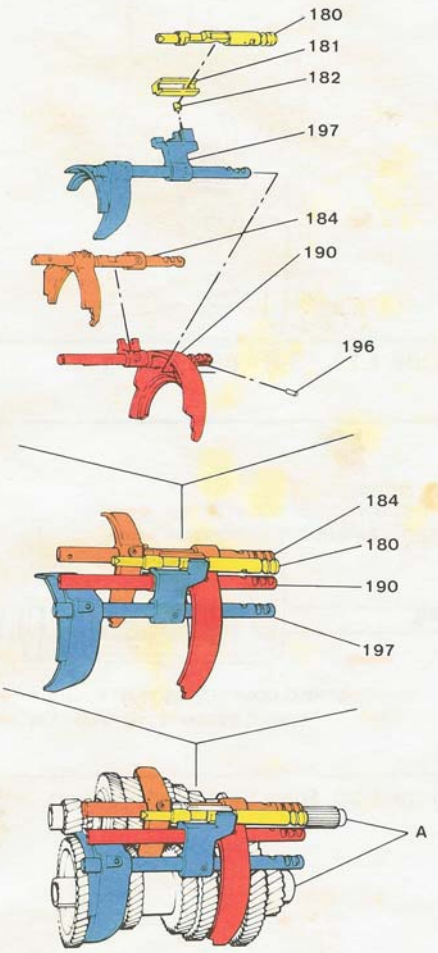


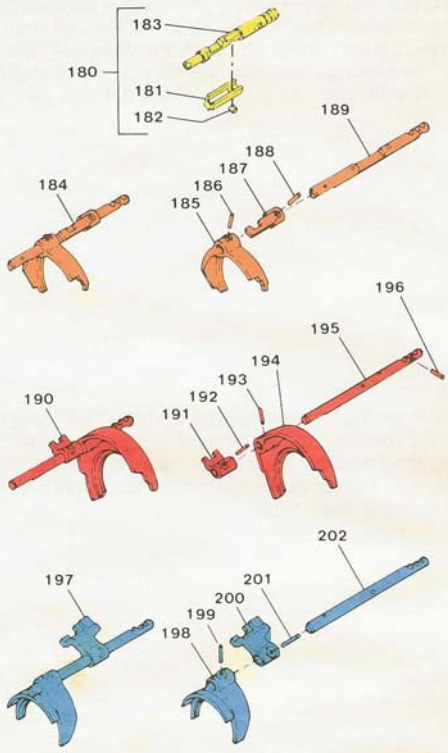

Figure 1-30, Bias Spring Movement.




A. GEAR CLUSTER AND SHIFT RAIL ASSEMBLY

180. REVERSE RAIL
181. SHIFT GATE
182. ROLLER
184. 3RD/4TH RAIL
190. 1ST/2ND RAIL
196. INTERLOCK PIN
197. 5TH RAIL

**Figure 1-31, Shift Rail Assemblies.**




180. RAIL, REVERSE SHIFT ASSEMBLY
181. SHIFT GATE, 5TH/REVERSE
182. ROLLER, GEAR DISENGAGE
183. SHAFT, REVERSE SHIFT
184. RAIL, 3RD/4TH SHIFT ASSEMBLY
185. FORK, 3RD/4TH SHIFT SHIFT
186. PIN, FORK RETAINER
187. LEVER, 3RD/4TH SELECT
188. PIN, LEVER RETAINER
189. SHAFT, 3RD/4TH SHIFT
190. RAIL, 1ST/2ND SHIFT ASSEMBLY
191. LEVER, 1ST/2ND SELECT
192. PIN, LEVER RETAINER
193. PIN, FORK RETAINER
194. FORK, 1ST/2ND SHIFT
195. SHAFT, 1ST/2ND SHIFT
196. PIN, LOCK
197. RAIL, 5TH SHIFT ASSEMBLY
198. FORK, 5TH SHIFT
199. PIN, FORK RETAINER
200. LEVER, 5TH SHIFT
201. PIN, LEVER RETAINER
202. SHAFT, 5TH SHIFT

**Figure 1-32, Shift Rail and Fork Assemblies.**

## Shift Rails

The shift rails are assemblies of forks, shafts, and notched levers (Figure 1-31).

They are fitted to the gear clusters (Figure 1-32) and respond to the pushing of the shift shaft internal shift lever as shown in Figures 1-33 through 1-39. The shift rails are supported by Teflon-coated bronze bushings in both the transmission case and the clutch and differential housing.

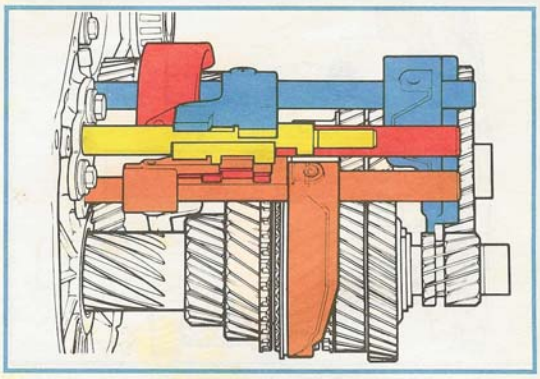


Figure 1-33, **Shift Rails in Neutral.**

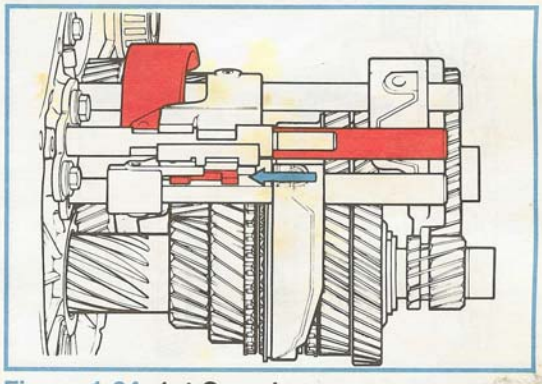


Figure 1-34, **1st Speed.**

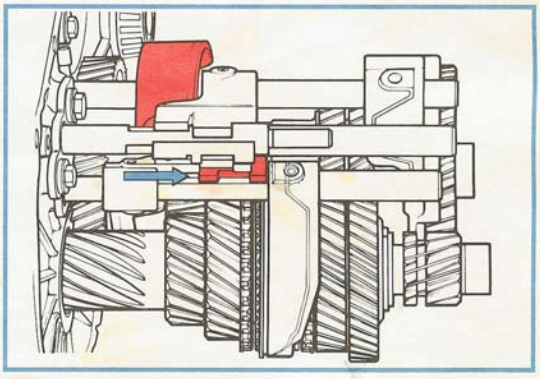


Figure 1-35, **2nd Speed.**

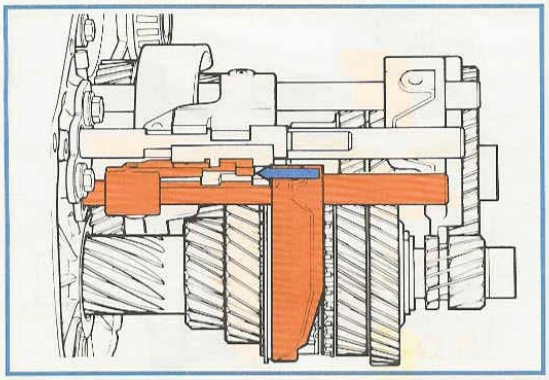


Figure 1-36, 3rd Speed.

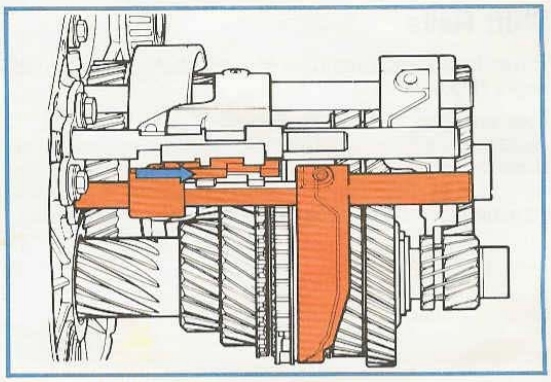


Figure 1-37, 4th Speed.

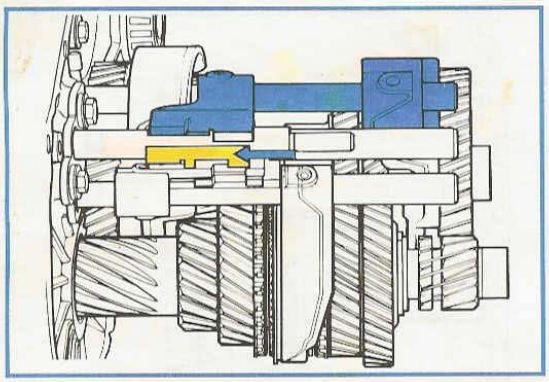


Figure 1-38, 5th Speed.

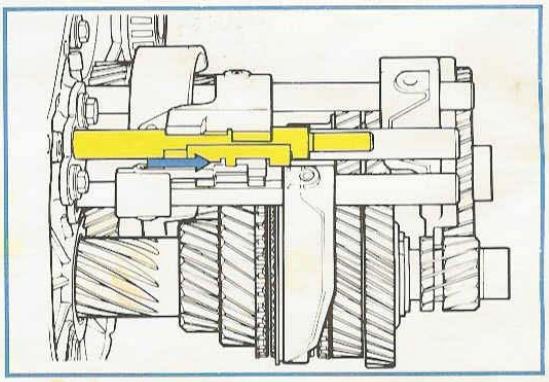


Figure 1-39, Reverse.

## REVERSE SHIFT LINKAGE

To accomplish the shift into reverse, the following occurs:

- The shift shaft internal shift lever pushes the reverse shift rail to the left, using the shift gate as its notched lever (Figure 1-40).
- The reverse lever, supported by the shift shaft through Teflon-coated bronze bushings, pivots as it is pushed by the reverse shift rail.

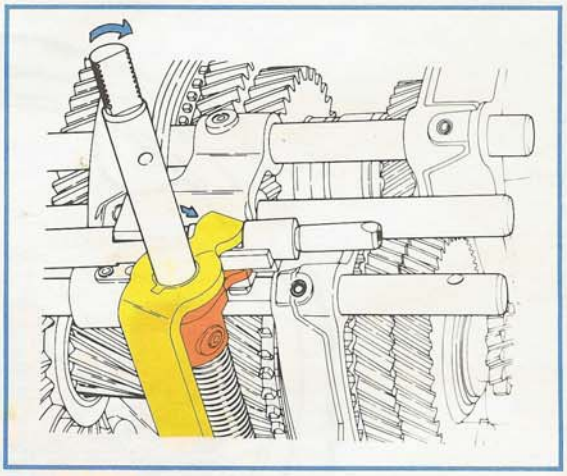


**Figure 1-40, Reverse Shift Rail Movement.**

- The pivoting lever pushes the reverse idler gear shift rail (with its forked end attached to the reverse idler gear) left. This causes the idler gear (already in mesh with the input shaft reverse gear) to slide into mesh with the output shaft reverse gear (Figure 1-41).

To accomplish shifting from reverse to neutral, the shift shaft internal shift lever pushes the shift gate (held to the reverse shift rail by the use of a disengage roller) to the right. All hardware linked to the reverse shift rail then responds to slide the reverse idler gear away from the output shaft reverse gear.

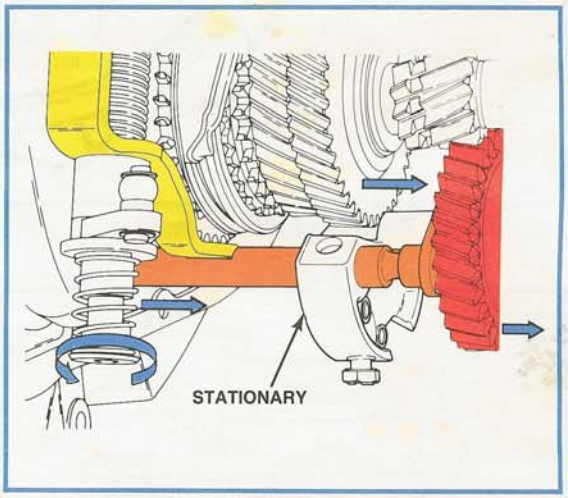



**Figure 1-41, Reverse Idler Gear Movement.**

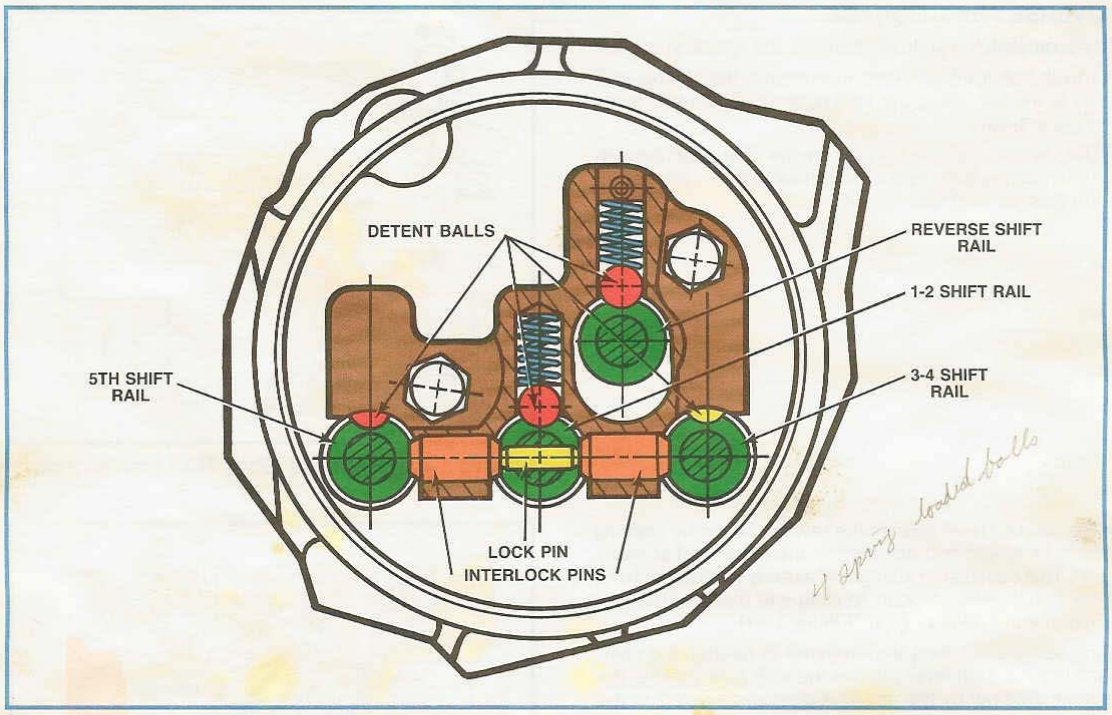



**Figure 1-42, Shift Rail Detent Holder.**

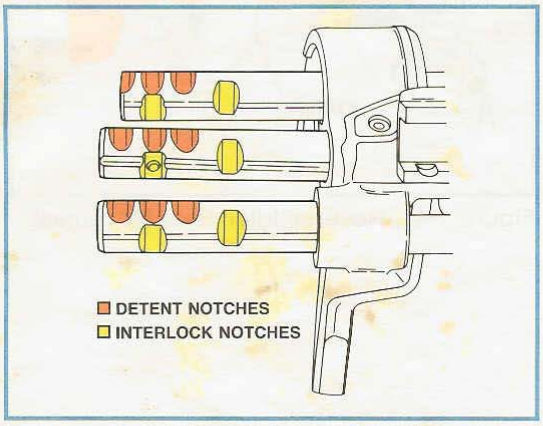



**Figure 1-43, Shift Rail Detent Notches.**

## SHIFT RAIL DETENTS

The shift rails have notches for detent and interlock control (Figure 1-43). The detent notches mate with spring-loaded balls held by a block. This block is mounted on the clutch and differential housing and protected from clutch housing debris by a rubber-coated metal cover (Figure 1-42).

The detent mechanism controls the travel of the shift rails, which adds to the shift "feel" feedback to the driver (provided by the shift shaft's detent lever).

## Shift Interlock

In neutral position, the interlock pins and lock pin are in a "center" position.

All three shift rails may move from their neutral positions (Figure 1-44).

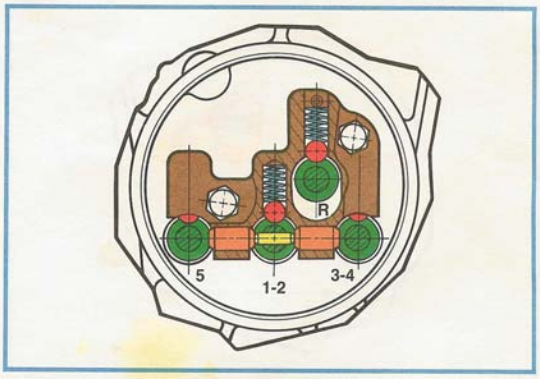



Figure 1-44, **Interlock in Neutral.**

In third or fourth speed, the interlock pins and lock pin are pushed as a "train" to lock the 1-2 and 5th shift rails in their neutral positions (Figure 1-45).

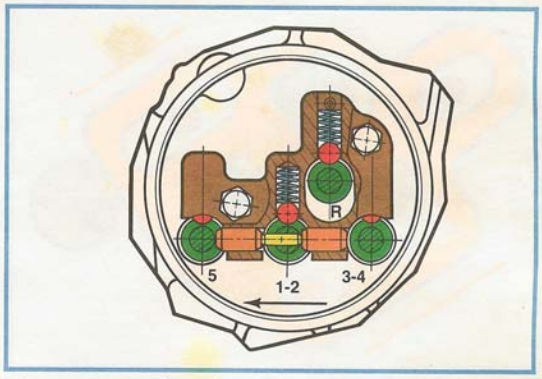



Figure 1-45, **Interlock in 3rd or 4th Speed.**

In fifth speed, the "train" of pins is pushed, locking the 1-2 and 3-4 shift rails in neutral positions (Figure 1-46).

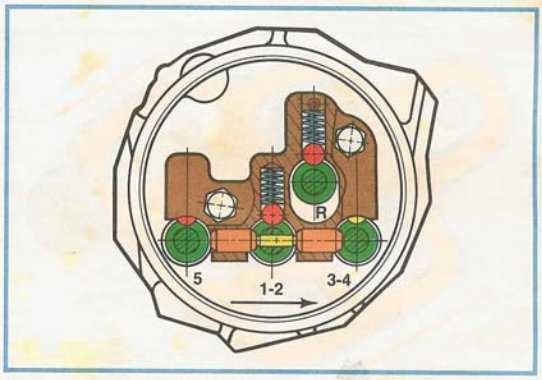



Figure 1-46, **Interlock in 5th Speed.**

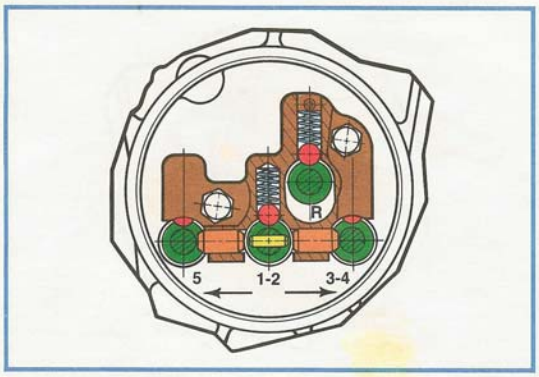



Figure 1-47, **Interlock in 1st or 2nd Speed.**

In first or second speeds, each interlock pin is pushed, locking the 3-4 and 5th shift rails in neutral positions (Figure 1-47).

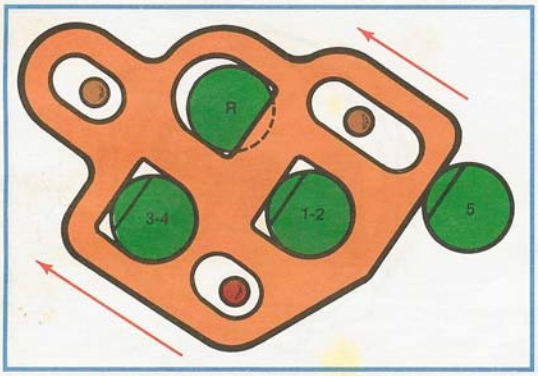



Figure 1-48, **Interlock Plate in Forward Speeds.**

The shift interlock plate will lock the reverse shift rail in neutral position when any of the other three shift rails is **not** in neutral position. A notch in the reverse rail is engaged by the plate's edge (Figure 1-48).

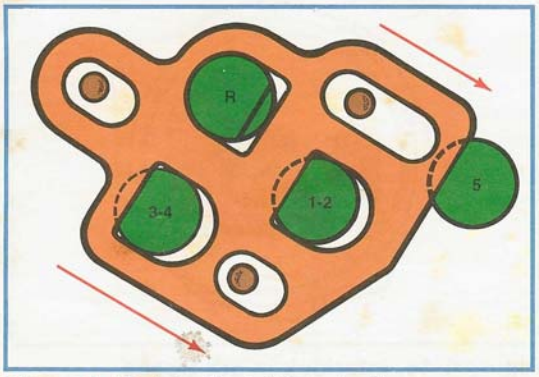



Figure 1-49, **Interlock Plate in Reverse.**

When the reverse rail is moved, notches in the other rails are engaged by the shift interlock plate edges. Now, the 1-2, 3-4 and 5th shift rails are locked into neutral position (Figure 1-49).

## Synchronizers

An MG282 synchronizer consists of:

- One hub (splined to a shaft under a light press fit).
- One sleeve (match-fitted to the hub).
- Three key assemblies, each with a ball and coil spring.
- One blocking ring (made of forged steel, with a laser-welded stainless steel insert which is coated with bronze).
- One speed gear, with a tapered cone clutch surface and a laser-welded ring of clutch teeth.

The MG282 uses three synchronizers for:

- 1st and 2nd speeds (Figure 1-50)

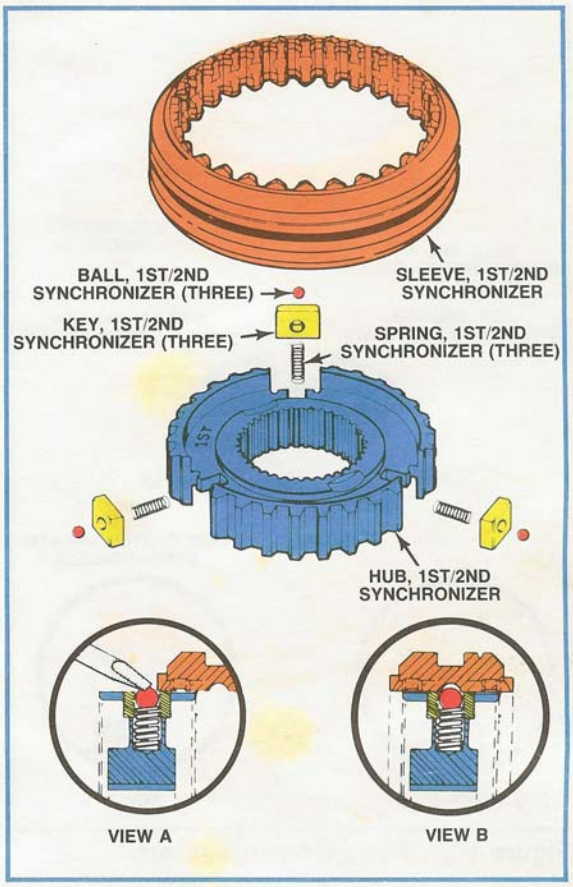



**Figure 1-50, The 1-2 Synchronizer.**

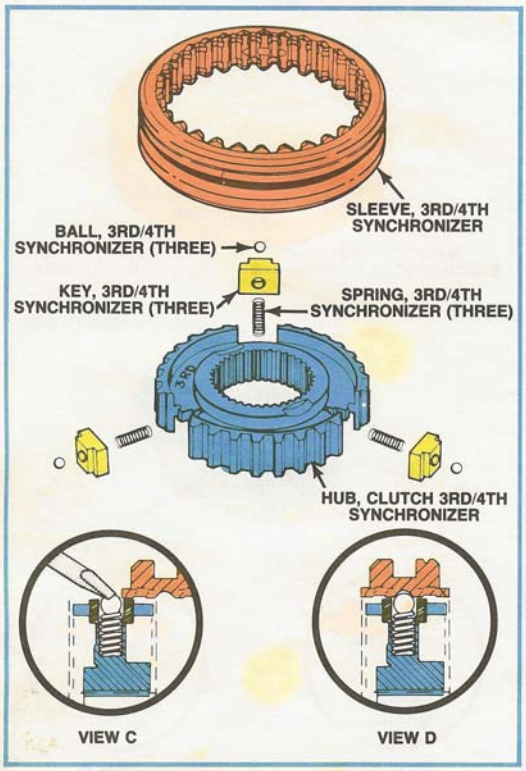



Figure 1-51, The 3-4 Synchronizer.

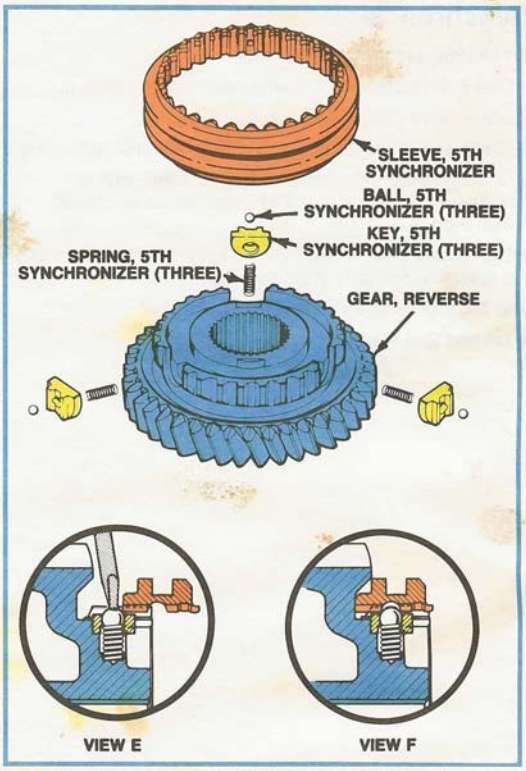



Figure 1-52, The 5th Speed Synchronizer.

- 3rd and 4th speeds (Figure 1-51)
- 5th speed (Figure 1-52)

The speed gears, together with their blocking rings, form the cone-type clutch assemblies required to synchronize the locking of gear-to-shaft (see Figure 1-53).

As mentioned earlier in this book, when the gears are not locked to their shafts, they rotate at speeds different than the shaft speeds on roller bearings.

When locked, the roller bearings support their respective gears without any motion involved.

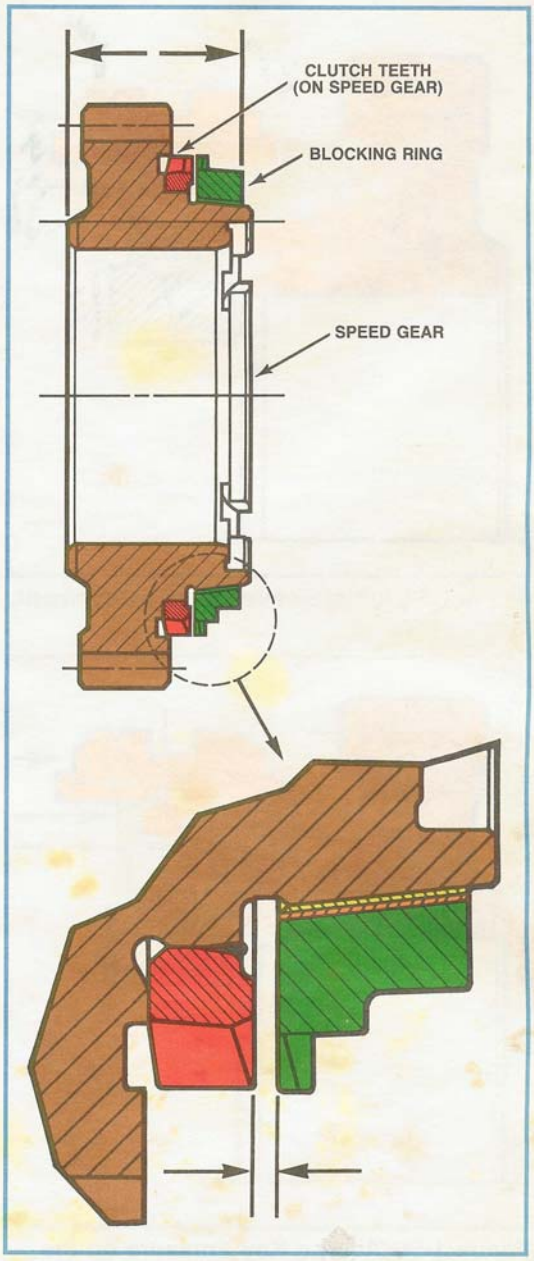



**Figure 1-53, Speed Gear Features.**

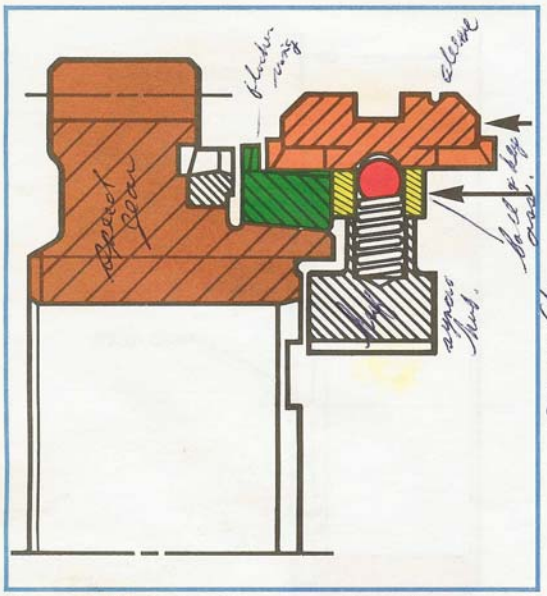


Figure 1-54, Initial Sleeve and Key Movement.

The operation of a cone clutch key-activated synchronizer used in the MG282 transaxle is as follows:

- The synchronizer sleeve is pushed by the shift fork toward the speed gear (Figure 1-54). The keys travel along with the sleeve, being held by the balls under spring pressure, and are in light contact with the blocking ring. (The keys are in the "neutral detent" position.)

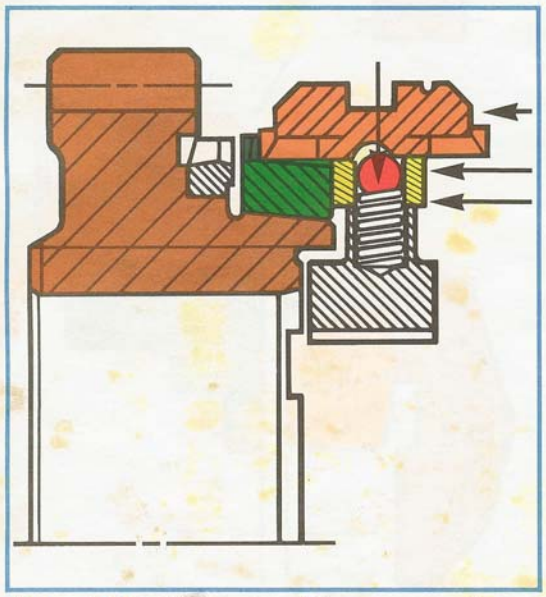


Figure 1-55, Adding Key Pressure on the Blocking Ring.

- The synchronizer sleeve is pushed further, causing the ball to come out of its pocket in the sleeve. This compresses the spring, and the key increases its pressure on the blocking ring (Figure 1-55). (The keys have left the "neutral detent" position.)

- The synchronizer tooth chamfers now contact the chamfered teeth of the blocking ring (Figure 1-56). This adds further pressure to the blocking ring, pushing its cone surface onto the mating cone surface of the gear.

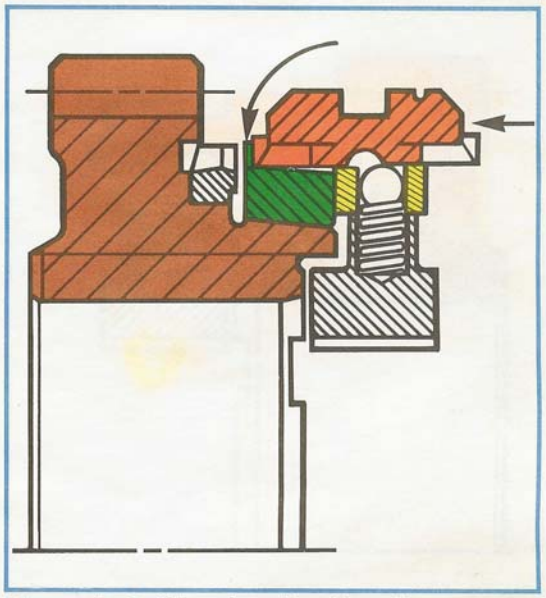


**Figure 1-56, Chamfers Pushing the Blocking Ring.**

- With constantly building pressure forcing the blocking ring's internal cone surface against the speed gear's cone surface, the clutch does its job and the gear and shaft are at the same speed (see Figure 1-57).

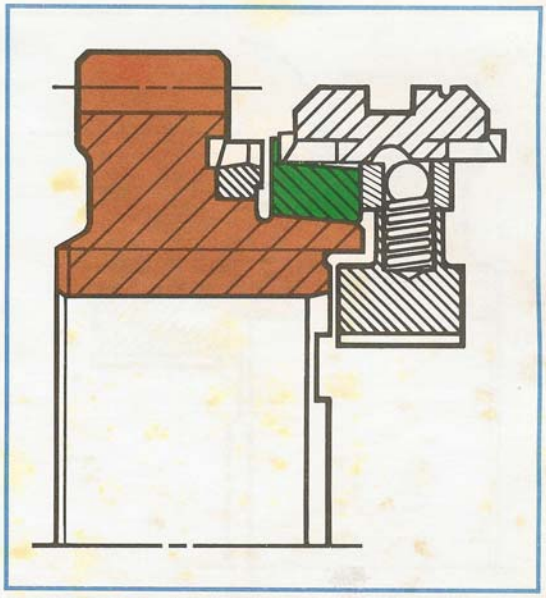


**Figure 1-57, Cone Clutch Operating.**

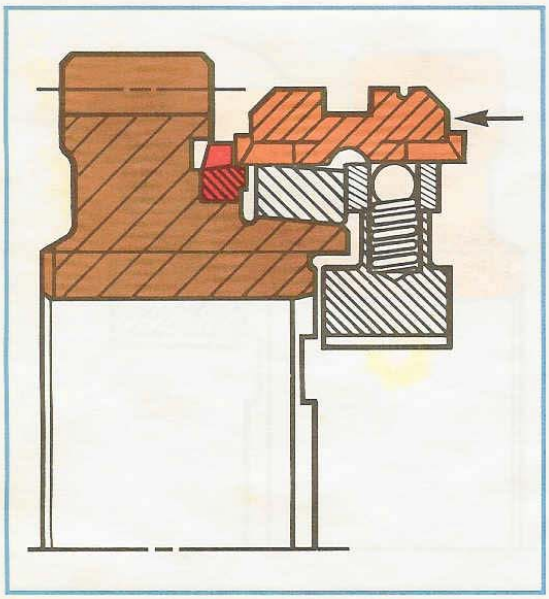


Figure 1-58, **Sleeve and Clutch Tooth Chamfers in Contact.**

- When there is no difference in rotating speed between the speed gear and the blocking ring/sleeve, the sleeve chamfers easily slide past the tooth chamfers of the blocking ring as the sleeve makes its way to the speed gear (Figure 1-58). The synchronizer sleeve tooth chamfers now contact the chamfered clutch teeth of the speed gear.

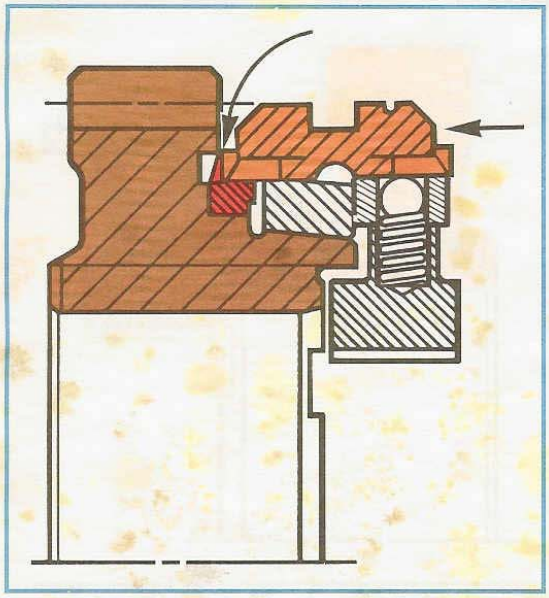


Figure 1-59, **Shift Complete.**

- Because no speed difference exists between the sleeve and the gear, the sleeve's tooth chamfers slide past the clutch tooth chamfers and into mesh. The shift is complete, since the speed gear's clutch teeth stop any further sliding of the synchronizer sleeve (Figure 1-59).

## PREVENTING HOPOUT

After the sleeve of the synchronizer meshes its teeth with those of the speed gear, the possibility of the sleeve being pushed away from the speed gear under torque loads exists.

The design of the sleeve teeth (Figure 1-60) and the speed gear clutch teeth (Figure 1-61) locks the two parts so that the condition (known as "hopout") will not occur.

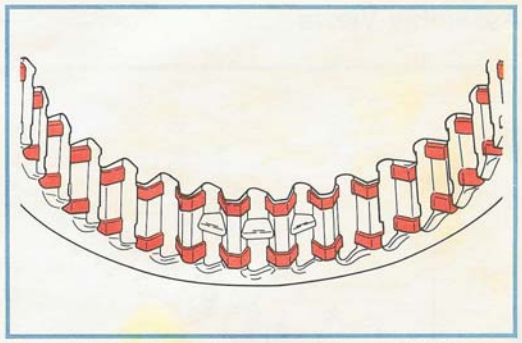


Figure 1-60, **Synchronizer Sleeve Notches.**

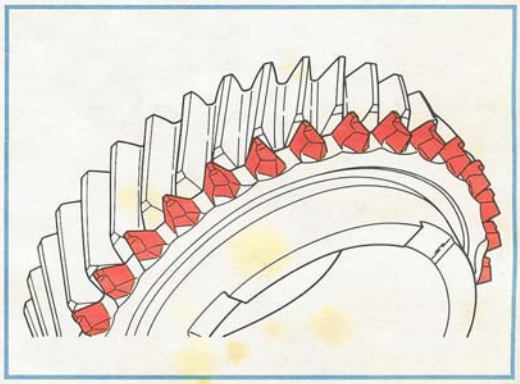


Figure 1-61, **Speed Gear Clutch Tooth Back-Taper.**

## Assembly Views

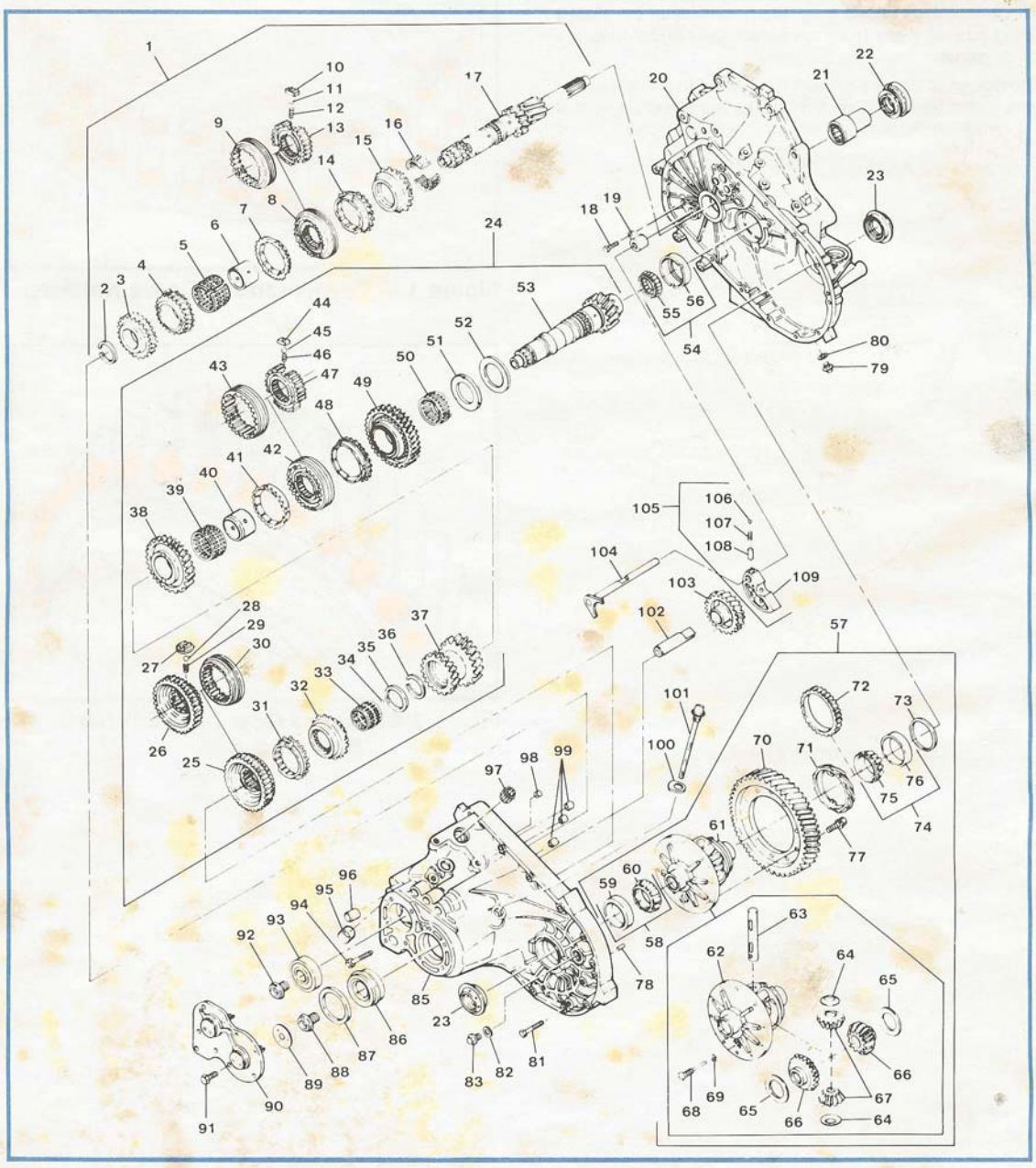



**Figure 1-62, Disassembled View – Gear and Case Group.**

MUNCIE (5-SPEED) TRANSAXLE GEAR AND CASE GROUP

1. SHAFT AND GEAR ASSEMBLY, INPUT CLUSTER
2. SNAP RING
3. GEAR, FIFTH INPUT
4. GEAR, FOURTH INPUT
5. BEARING, CAGE
6. RACE, NEEDLE
7. RING, BLOCKER 4TH
8. SYNCHRONIZER ASSEMBLY, 3RD/4TH
9. SLEEVE, 3RD/4TH SYNCHRONIZER
10. KEY, 3RD/4TH SYNCHRONIZER (THREE)
11. BALL, 3RD/4TH SYNCHRONIZER (THREE)
12. SPRING, 3RD/4TH SYNCHRONIZER (THREE)
13. HUB, CLUTCH, 3RD/4TH SYNCHRONIZER
14. RING, BLOCKER 3RD
15. GEAR, THIRD INPUT
16. BEARING, CAGE (TWO)
17. SHAFT, INPUT
18. BOLT/SCREW, M6 X 1 X 12
19. GUIDE, REVERSE SHIFT RAIL
20. HOUSING, CLUTCH AND DIFFERENTIAL
21. BEARING/SLEEVE ASSEMBLY, INPUT SHAFT
22. BEARING ASSEMBLY, CLUTCH RELEASE
23. SEAL, OIL DRIVE AXLE
24. SHAFT AND GEAR ASSEMBLY, OUTPUT CLUSTER
25. GEAR, REVERSE OUTPUT/5TH SYNCHRONIZER ASSEMBLY
26. GEAR, REVERSE
27. KEY, 5TH SYNCHRONIZER (THREE)
28. BALL, 5TH SYNCHRONIZER (THREE)
29. SPRING, 5TH SYNCHRONIZER (THREE)
30. SLEEVE, 5TH SYNCHRONIZER
31. RING, BLOCKER 5TH GEAR
32. GEAR, 5TH SPEED OUTPUT
33. BEARING, 5TH SPEED OUTPUT
34. BALL, THRUST WASHER POSITIONER
35. WASHER, THRUST
36. SNAP RING
37. GEAR, 3RD/4TH CLUSTER
38. GEAR, 2ND OUTPUT
39. BEARING, 2ND OUTPUT
40. RACE, BEARING 2ND OUTPUT
41. RING, BLOCKER 2ND GEAR
42. SYNCHRONIZER ASSEMBLY, 1ST/2ND GEAR
43. SLEEVE, 1ST/2ND SYNCHRONIZER
44. KEY, 1ST/2ND SYNCHRONIZER (THREE)
45. BALL, 1ST/2ND SYNCHRONIZER (THREE)
46. SPRING, 1ST/2ND SYNCHRONIZER (THREE)
47. HUB, 1ST/2ND SYNCHRONIZER
48. RING, BLOCKER 1ST GEAR
49. GEAR, 1ST OUTPUT
50. BEARING, 1ST OUTPUT
51. BEARING, THRUST
52. WASHER, THRUST
53. SHAFT, OUTPUT
54. BEARING, OUTPUT SHAFT SUPPORT
55. BEARING, OUTPUT
56. RACE, BEARING OUTPUT
57. GEAR AND DIFFERENTIAL ASSEMBLY
58. BEARING, ASSEMBLY DIFFERENTIAL
59. RACE, BEARING DIFFERENTIAL
60. BEARING, DIFFERENTIAL
61. CASE, DIFFERENTIAL ASSEMBLY
62. CASE, DIFFERENTIAL
63. PIN, CROSS DIFFERENTIAL
64. WASHER, THRUST PINION GEAR
65. WASHER, THRUST SIDE GEAR
66. GEAR, SIDE DIFFERENTIAL
67. GEAR, PINION DIFFERENTIAL
68. BOLT/SCREW, PINION GEAR SHAFT
69. WASHER, LOCK
70. GEAR, RING DIFFERENTIAL
71. GEAR, SPEEDO OUTPUT (MECHANICAL)
72. GEAR, SPEEDO OUTPUT (ELECTRONIC)
73. SHIM, DIFFERENTIAL (SELECTIVE)
74. BEARING, ASSEMBLY DIFFERENTIAL
75. BEARING, DIFFERENTIAL
76. RACE, BEARING DIFFERENTIAL
77. BOLT/SCREW, DIFFERENTIAL RING (10)
78. PIN (TWO)
79. PLUG, OIL DRAIN
80. WASHER
81. BOLT/SCREW, TRANSMISSION CASE, M8 X 1.25.50 (15)
82. WASHER
83. PLUG
84.
85. CASE, TRANSMISSION
86. BEARING, OUTPUT GEAR
87. SHIM, OUTPUT GEAR (SELECTIVE)
88. RETAINER, OUTPUT GEAR BEARING
89. WASHER, OIL SLINGER
90. END PLATE, TRANSMISSION CASE
91. BOLT/SCREW, M8 X 1 X 18 (9)
92. RETAINER, INPUT GEAR BEARING
93. BEARING, INPUT GEAR
94. BOLT/SCREW, REVERSE IDLER, M8 X 1.25.50
95. BUSHING, DETENT LEVER
96. BUSHING, SLIDING SLEEVE
97. BEARING, NEEDLE SHIFT SHAFT
98. BUSHING, REVERSE RAIL
99. BUSHING, SHIFT RAIL (THREE)
100. WASHER, FLUID LEVER INDICATOR
101. FLUID LEVEL INDICATOR
102. SHAFT, REVERSE IDLER
103. GEAR, REVERSE IDLER
104. RAIL, REVERSE SHIFT IDLER GEAR
105. BRACKET, ASSEMBLY REVERSE IDLER GEAR
106. BALL, BRACKET REVERSE IDLER GEAR
107. SPRING, BRACKET REVERSE IDLER GEAR
108. SLEEVE, DETENT BRACKET REVERSE IDLER GEAR
109. BRACKET, REVERSE IDLER GEAR

**Figure 1-62, Disassembled View – Gear and Case Group, Continued.**

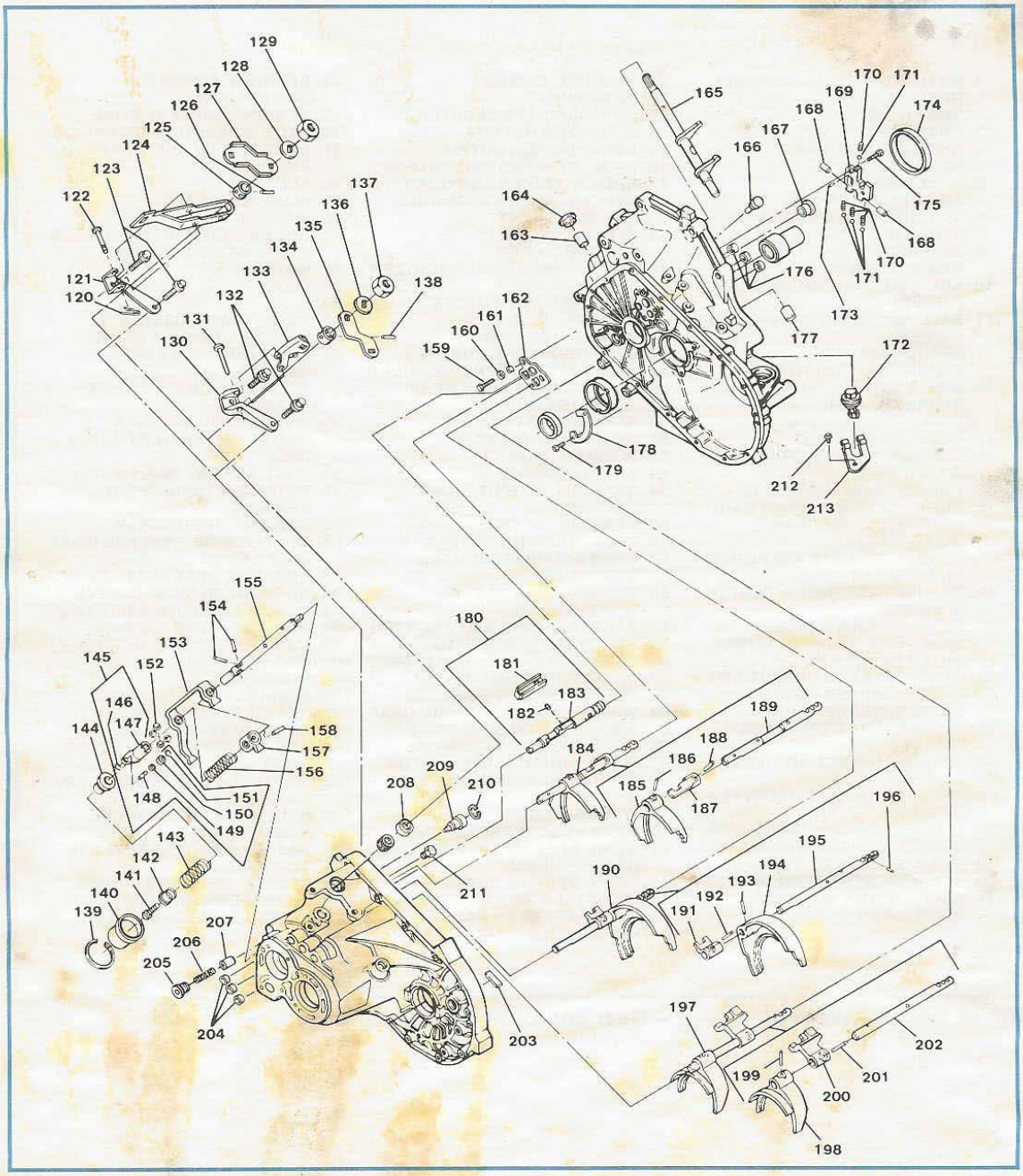



Figure 1-63, Disassembled View – Shift Mechanism Group.

MUNCIE (5-SPEED) TRANSAXLE SHIFT MECHANISM GROUP

120. RETAINER, SELECTOR PIN
121. RETAINER, SELECTOR LEVER
122. PIN, SELECTOR LEVER PIVOT
123. BOLT/SCREW, M8 X 1.25 X 20 (TWO)
124. LEVER, SELECTOR
125. COLLAR, SHIFT SHAFT
126. PIN, SPRING
127. LEVER, SHIFT
128. WASHER
129. NUT, M14 X 2
130. RETAINER, SELECTOR LEVER
131. PIN, SELECTOR LEVER PIVOT
132. BOLT/SCREW, M8 X 1.25 X 20 (TWO)
133. LEVER, SELECTOR
134. COLLAR, SHIFT SHAFT
135. LEVER, SHIFT
136. WASHER
137. NUT, M14 X 2
138. PIN, SPRING
139. SNAP RING
140. COVER, SHIFT SHAFT
141. BOLT/SCREW, M20 X 1.5
142. SEAT, SPRING 5TH DETENT OUTER
143. SPRING
144. SEAT, SPRING 5TH DETENT INNER
145. LEVER, DETENT ASSEMBLY
146. RETAINER, PIN DETENT
147. LEVER, DETENT
148. PIN, DETENT LEVER
149. SPACER, DETENT LEVER
150. ROLLER, DETENT LEVER
151. RETAINER, PIN DETENT
152. ROLLER, DETENT (FOUR)
153. LEVER, REVERSE
154. PIN, DETENT LEVER ROLLERS (TWO)
155. SHAFT, SHIFT
156. SPRING, 3RD/4TH BIAS
157. LEVER, SHIFT
158. PIN, ROLL
159. BOLT/SCREW, M6 X 1 X 12 (THREE)
160. WASHER, FLAT (THREE)
161. SPACER (THREE)
162. PLATE, SHIFT INTERLOCK
163. BUSHING, OUTER CLUTCH FORK
164. SEAL, CLUTCH FORK
165. SHAFT, CLUTCH FORK
166. BREATHER ASSEMBLY
167. BUSHING, REVERSE SHIFT RAIL
168. PIN, INTERLOCK (TWO)
169. HOLDER, DETENT
170. SPRING, DETENT (FOUR)
171. BALL, DETENT (FOUR)
172. SPEEDO SIGNAL ASSEMBLY
173. PIN, SPRING
174. COVER, DETENT HOLDER
175. BOLT/SCREW, M6 X 1 X 30 (TWO)
176. BUSHINGS, SHIFT RAIL (THREE)
177. BUSHING, INNER CLUTCH FORK
178. RETAINER, OUTPUT BEARING RACE
179. BOLT/SCREW, M6 X 1 X 12 (TWO)
180. RAIL, REVERSE SHIFT ASSEMBLY
181. SHIFT GATE, 5TH/REVERSE
182. ROLLER, GEAR DISENGAGE
183. SHAFT, REVERSE SHIFT
184. RAIL, 3RD/4TH SHIFT ASSEMBLY
185. FORK, 3RD/4TH SHIFT SHIFT
186. PIN, FORK RETAINER
187. LEVER, 3RD/4TH SELECT
188. PIN, LEVER RETAINER
189. SHAFT, 3RD/4TH SHIFT
190. RAIL, 1ST/2ND SHIFT ASSEMBLY
191. LEVER, 1ST/2ND SELECT
192. PIN, LEVER RETAINER
193. PIN, FORK RETAINER
194. FORK, 1ST/2ND SHIFT
195. SHAFT, 1ST/2ND SHIFT
196. PIN, LOCK
197. RAIL, 5TH SHIFT ASSEMBLY
198. FORK, 5TH SHIFT
199. PIN, FORK RETAINER
200. LEVER, 5TH SHIFT
201. PIN, LEVER RETAINER
202. SHAFT, 5TH SHIFT
203. MAGNET, CHIP COLLECTOR
204. PLUG, SHIFT RAIL (THREE)
205. BOLT/SCREW, M2 X 1.5
206. SPRING, SLIDING SLEEVE
207. SLEEVE, SLIDING
208. SEAL, SHIFT SHAFT
209. PLUG
210. SNAP RING
211. STUD
212. SPEEDO SIGNAL ASSEMBLY RETAINER
213. BOLT

**Figure 1-63, Disassembled View – Shift Mechanism Group, Continued.**

# 2. Powerflow

## Powerflow: Neutral to First Speed Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 0 mph
Component speeds: Input shaft – 1000 rpm; Output shaft – 0 rpm; Differential – 0 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the foot pedal.
- The driver moves the shift control lever to the "1-2" position, pulling the select cable.
- The select cable pulls the select lever, which pushes the shift shaft down to make the internal shift lever align with the 1-2 shift rail notch.
- The driver moves the shift control lever forward, which pulls the shift cable.
- The shift cable pulls the external shift lever, which rotates the shift shaft counterclockwise.
- The internal shift lever pushes the 1-2 shift rail/fork assembly right, moving the synchronizer sleeve.
- The interlock pins prevent movement of the 3-4 and 5th shift rails, and the interlock plate holds the reverse shift rail.

### SYNCHRONIZER OPERATION

- The 1-2 synchronizer sleeve slides toward the 1st speed gear, pushing the keys into contact with the 1st gear blocking ring.
- The synchronizer sleeve continues to slide toward the 1st speed gear, causing the keys to leave "neutral detent" position as they push the blocking ring.
- The synchronizer sleeve tooth chamfers push the blocking ring chamfers, pushing the blocking ring onto the 1st speed gear cone surface.
- The output shaft (through the blocking ring) slows down 1st speed gear.
- The synchronizer sleeve tooth chamfers slide past the blocking ring tooth chamfers as the sleeve moves past the blocking ring.
- The synchronizer sleeve tooth chamfers slide past the 1st speed gear clutch tooth chamfers as the sleeve slides into mesh with the gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft 1st gear.
- The input shaft 1st gear teeth push the output shaft 1st speed gear teeth, and they rotate at a 3.50 to 1 ratio.
- The output shaft gear teeth push the differential ring gear teeth and they rotate at a 3.61 to 1 ratio.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

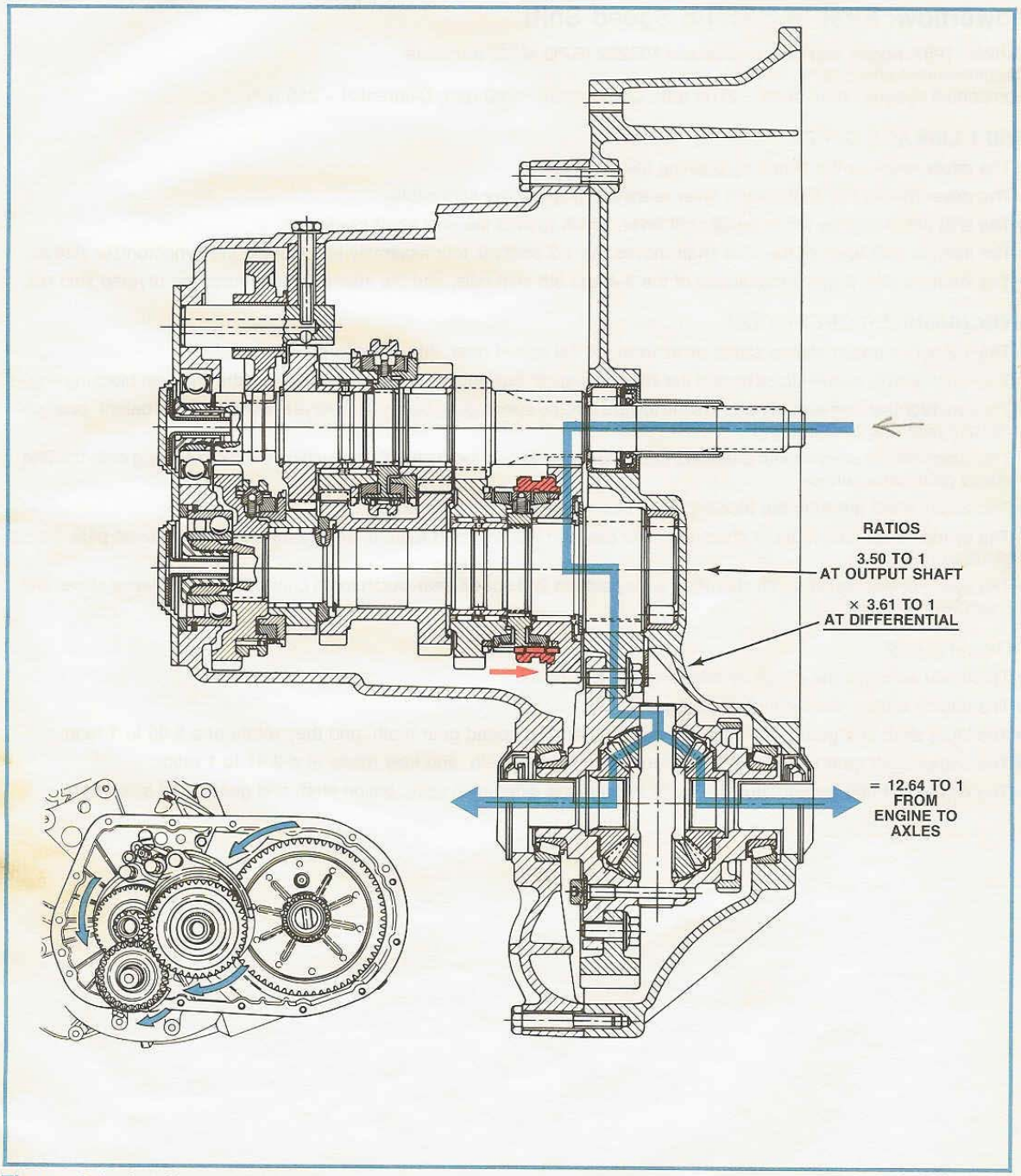



Figure 2-1, 1st Speed Powerflow.

## Powerflow: First to Second Speed Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 15 mph
Component speeds: Input shaft – 2700 rpm; Output shaft – 780 rpm; Differential – 215 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the foot pedal.
- The driver moves the shift control lever rearward, pushing the shift cable.
- The shift cable pushes the external shift lever, which rotates the shift shaft clockwise.
- The internal shift lever of the shift shaft moves the 1-2 shift rail fork assembly left, moving the synchronizer sleeve.
- The interlock pins prevent movement of the 3-4 and 5th shift rails, and the interlock plate holds the reverse shift rail.

### SYNCHRONIZER OPERATION

- The 1-2 synchronizer sleeve slides away from the 1st speed gear, into "neutral detent" position.
- The synchronizer sleeve slides toward the 2nd speed gear, pushing the keys into contact with the 2nd gear blocking ring.
- The synchronizer sleeve continues to slide toward the 2nd speed gear, causing the keys to leave "neutral detent" position as they push the blocking ring.
- The synchronizer sleeve tooth chamfers push the blocking ring tooth chamfers, pushing the blocking ring onto the 2nd speed gear cone surface.
- The output shaft (through the blocking ring) slows down the 2nd speed gear.
- The synchronizer sleeve tooth chamfers slide past the blocking ring tooth chamfers as the sleeve moves past the blocking ring.
- The synchronizer sleeve tooth chamfers slide past the 2nd speed gear clutch tooth chamfers as the sleeve slides into mesh with the gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft 2nd gear.
- The input shaft 2nd gear teeth push the output shaft 2nd speed gear teeth, and they rotate at a 2.05 to 1 ratio.
- The output shaft gear teeth push the differential ring gear teeth, and they rotate at a 3.61 to 1 ratio.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

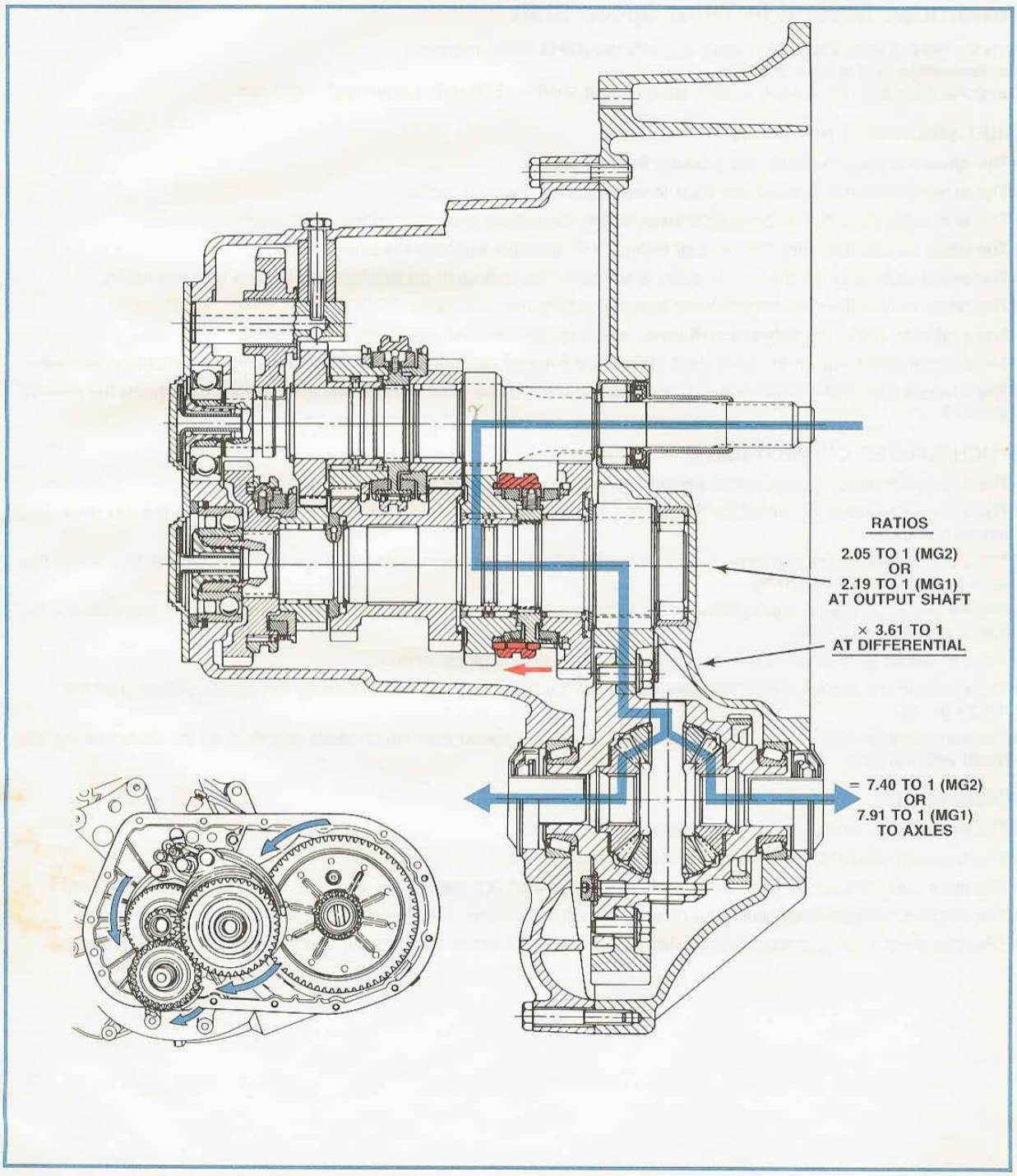



**Figure 2-2, 2nd Speed Powerflow.**

## Powerflow: Second to Third Speed Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 30 mph
Component speeds: Input shaft – 3200 rpm; Output shaft – 1560 rpm; Differential – 430 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the foot pedal.
- The driver moves the shift control lever forward, pulling the shift cable.
- The shift cable pulls the external shift lever, which rotates the shift shaft to the "1-2" position.
- The driver moves the shift control lever to the "3-4" position, pushing the select cable.
- The select cable pushes the select lever, which pulls the shift shaft up to align with the 3-4 shift rail notch.
- The driver moves the shift control lever forward, pulling the shift cable.
- The shift cable pulls the external shift lever, which rotates the shift shaft counterclockwise.
- The internal shift lever on the shift shaft moves the 3-4 shift rail/fork assembly right, moving the synchronizer sleeve.
- The interlock pins and lock pin prevent movement of the 1-2 and 5th shift rails, and the interlock plate holds the reverse shift rail.

### SYNCHRONIZER OPERATION

- The 1-2 synchronizer sleeve slides away from the 2nd speed gear, into "neutral detent" position.
- The 3-4 synchronizer sleeve slides toward the 3rd speed gear, pushing the keys into contact with the 3rd gear blocking ring.
- The synchronizer sleeve continues to slide toward the 3rd speed gear, causing the keys to leave "neutral detent" position as they push the blocking ring.
- The synchronizer sleeve tooth chamfers push the blocking ring tooth chamfers, pushing the blocking ring onto the 3rd speed gear cone surface.
- The 3rd speed gear slows down the input shaft (through the blocking ring).
- The synchronizer sleeve tooth chamfers slide past the block ring tooth chamfers as the sleeve moves past the blocking ring.
- The synchronizer sleeve tooth chamfers slide past the 3rd speed gear clutch tooth chamfers as the sleeve slides into mesh with the gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft 3rd speed gear.
- The input shaft 3rd speed gear teeth push the output shaft 3rd gear teeth, and they rotate at a 1.38 to 1 ratio.
- The output shaft gear teeth push the differential ring gear teeth, and they rotate at a 3.61 to 1 ratio.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

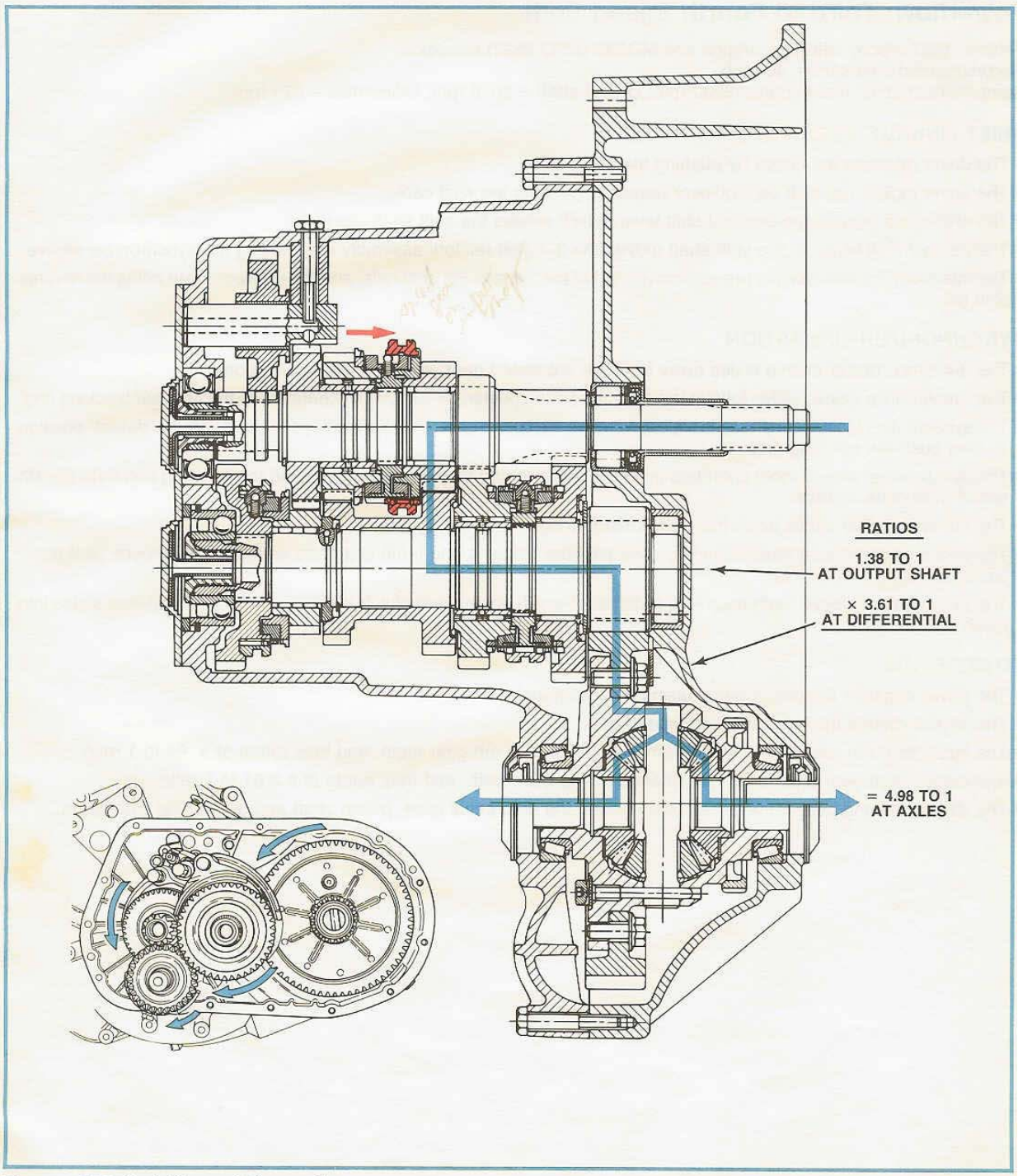



Figure 2-3, 3rd Speed Powerflow.

## Powerflow: Third to Fourth Speed Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 40 mph
Component speeds: Input shaft – 2900 rpm; Output shaft – 2075 rpm; Differential – 575 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the foot pedal.
- The driver moves the shift control lever rearward, pushing the shift cable.
- The shift cable pushes the external shift lever, which rotates the shift shaft clockwise.
- The internal shift lever on the shift shaft moves the 3-4 shift rail/fork assembly left, moving the synchronizer sleeve.
- The interlock pins and lock pin prevent movement of the 1-2 and 5th shift rails, and the interlock plate holds the reverse shift rail.

### SYNCHRONIZER OPERATION

- The 3-4 synchronizer sleeve slides away from the 3rd speed gear, into "neutral detent" position.
- The synchronizer sleeve slides toward the 4th speed gear, pushing the keys into contact with the 4th gear blocking ring.
- The synchronizer sleeve continues to slide toward the 4th speed gear, causing the keys to leave "neutral detent" position as they push the blocking ring.
- The synchronizer sleeve tooth chamfers push the blocking ring tooth chamfers, pushing the blocking ring onto the 4th speed gear cone surface.
- The 4th speed gear slows down the input shaft (through the blocking ring).
- The synchronizer sleeve tooth chamfers slide past the blocking ring tooth chamfers as the sleeve moves past the blocking ring.
- The synchronizer sleeve tooth chamfers slide past the 4th speed gear clutch tooth chamfers as the sleeve slides into mesh with the gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft 4th speed gear.
- The input shaft 4th speed gear teeth push the output shaft 4th gear teeth, and they rotate at a .94 to 1 ratio.
- The output shaft gear teeth push the differential ring gear teeth, and they rotate at a 3.61 to 1 ratio.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

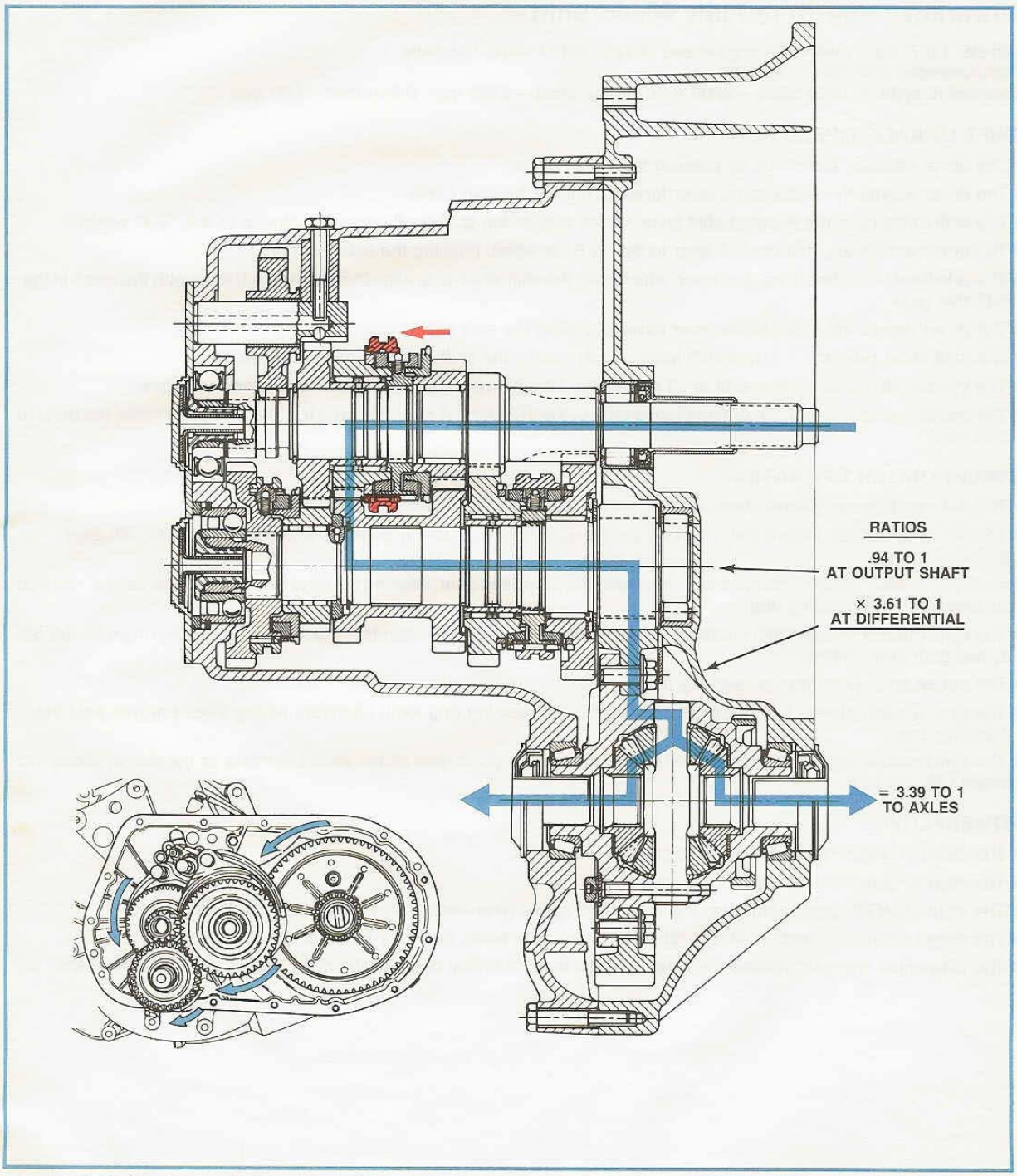



Figure 2-4, **4th Speed Powerflow.**

## Powerflow: Fourth to Fifth Speed Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 45 mph
Component speeds: Input shaft – 2200 rpm; Output shaft – 2350 rpm; Differential – 650 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the clutch pedal.
- The driver moves the shift control lever forward, pulling the shift cable.
- The shift cable pulls the external shift lever, which rotates the shift shaft counterclockwise to the "3-4" position.
- The driver moves the shift control lever to the "5-R" position, pushing the select cable.
- The select cable pushes the select lever, which pulls the shift shaft up to align the internal shift lever with the notch in the 5-R shift gate.
- The driver moves the shift control lever forward, pulling the shift cable.
- The shift cable pulls the external shift lever, which rotates the shift shaft counterclockwise.
- The internal shift lever on the shift shaft moves the 5th shift rail right, moving the synchronizer sleeve.
- The interlock pins and lock pin prevent movement of the 1-2 and 3-4 shift rails, and the interlock plate holds the reverse shift rail.

### SYNCHRONIZER OPERATION

- The 3-4 synchronizer sleeve slides away from the 4th gear, into "neutral detent" position.
- The 5th synchronizer sleeve slides toward the 5th speed gear, pushing the keys into contact with the 5th gear blocking ring.
- The synchronizer sleeve continues to slide toward the 5th speed gear, causing the keys to leave "neutral detent" position as they push the blocking ring.
- The synchronizer sleeve tooth chamfers push the blocking ring tooth chamfers, pushing the blocking ring onto the 5th speed gear cone surface.
- The output shaft (through the blocking ring) speeds up the 5th speed gear.
- The synchronizer sleeve tooth chamfers slide past the blocking ring tooth chamfers as the sleeve moves past the blocking ring.
- The synchronizer sleeve tooth chamfers slide past the 5th speed gear clutch tooth chamfers as the sleeve slides into mesh with the gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft 5th gear.
- The input shaft 5th gear teeth push the output 5th speed gear teeth, and they rotate at a .72 to 1 ratio.
- The output shaft gear teeth push the differential ring gear teeth, and they rotate at a 3.61 to 1 ratio.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

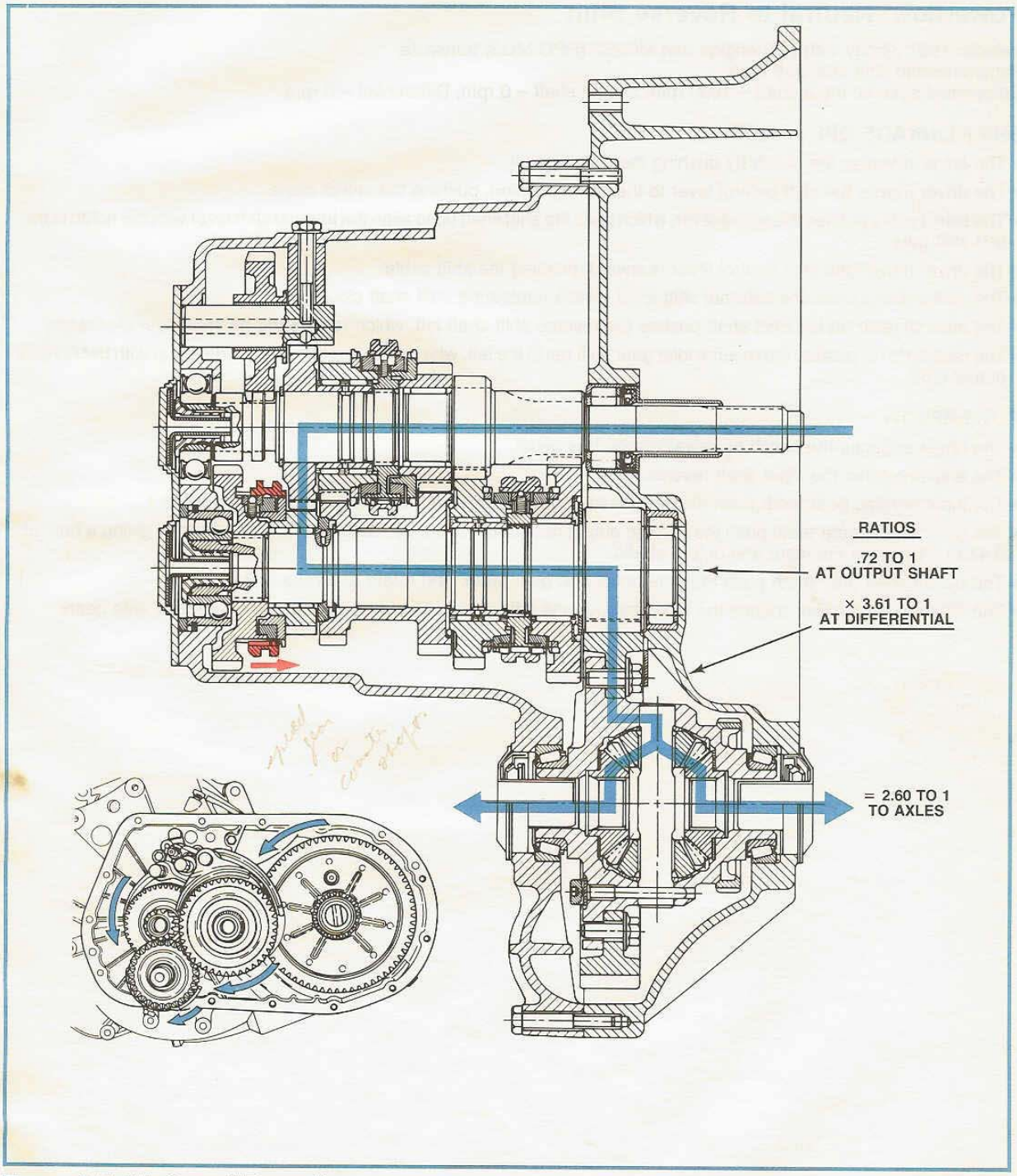



Figure 2-5, 5th Speed Powerflow.

## Powerflow: Neutral to Reverse Shift

Vehicle: 1987 J-body with LB6 engine and MG282 (RPO MG2) transaxle
Recommended shift speed: 0 mph
Component speeds: Input shaft – 1000 rpm; Output shaft – 0 rpm; Differential – 0 rpm

### SHIFT LINKAGE OPERATION

- The driver releases the clutch by pushing the clutch pedal.
- The driver moves the shift control lever to the "5-R" position, pushing the select cable.
- The select cable pushes the select lever, which pulls the shift shaft up to align the internal shift lever with the notch in the 5-R shift gate.
- The driver moves the shift control lever rearward, pushing the shift cable.
- The shift cable pushes the external shift lever, which rotates the shift shaft clockwise.
- The internal lever on the shift shaft pushes the reverse shift shaft left, which rotates the reverse lever clockwise.
- The reverse lever pushes the reverse idler gear shift rail to the left, which engages the reverse idler gear with the reverse output gear.

### POWERFLOW

- The driver engages the clutch by releasing the foot pedal.
- The engine rotates the input shaft reverse gear.
- The input reverse gear teeth push the reverse idler gear teeth, and they rotate at a ratio of 2.42 to 1.
- The reverse idler gear teeth push the reverse output gear teeth, and they rotate at a ratio of 1.41 to 1, giving a ratio of 3.41 to 1 between the input and output shafts.
- The output shaft gear teeth push the differential ring gear teeth, and rotate at a ratio of 3.61 to 1.
- The differential ring gear rotates the axles through the differential case, pinion shaft and gears, and side gears.

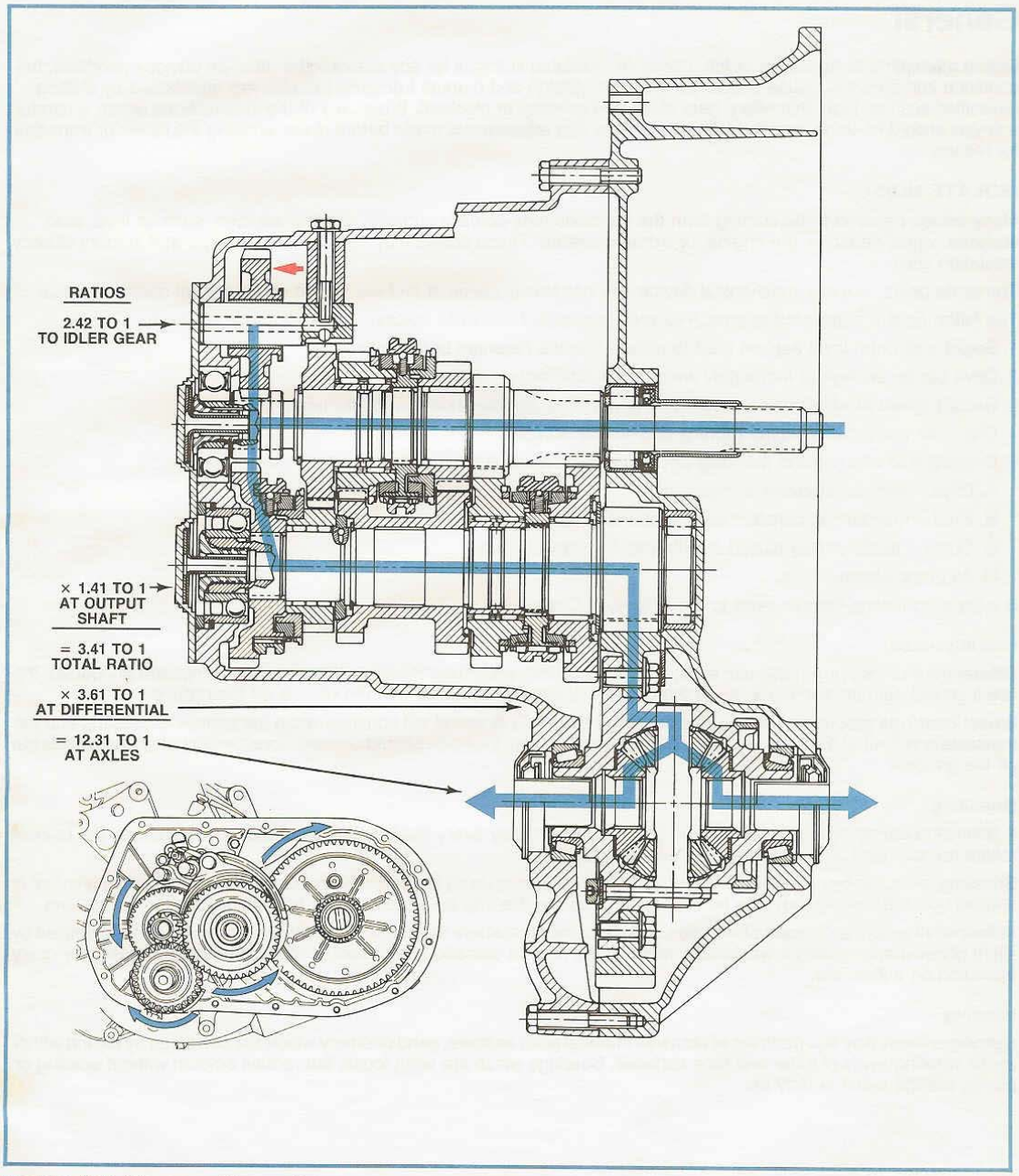



**Figure 2-6, Reverse Powerflow.**

# 3. Diagnosis

## General

Before attempting to repair the clutch, transaxle or related linkages for any reason other than an obvious condition, the condition and probable cause should be identified. Clutch and manual transaxle troubles are manifested by shifting difficulties such as high shift effort, gear clash and grinding or blockout. When any of these conditions occur, a careful analysis should be done, and the following checks and adjustments made before disassembling the clutch or transaxle for repairs.

### ISOLATE NOISE

Many noises believed to be coming from the transaxle may actually originate at other sources, such as tires, road surfaces, wheel bearings, the engine, or exhaust system. These noises may vary by car size, type and amount of body insulation used.

Transaxle gears, like any mechanical device, are not absolutely quiet and will exhibit some normal operating noise.

The following is a suggested approach to verify suspected transaxle noises.

1. Select a smooth, level asphalt road to reduce tire and resonant body noise.
2. Drive car far enough to thoroughly warm up all lubricants.
3. Record speed at which noise occurs and gear range the transaxle is in at the time.
4. Check for noises with engine running and vehicle stopped.
5. Determine in which of the following drive conditions noise is occurring:
   A. Drive – light acceleration or heavy pull.
   B. Float – maintaining constant vehicle speed at light throttle on a level road.
   C. Coast – partly or fully closed throttle with transaxle in gear.
   D. All of the above.
6. After road testing the car, refer to the Diagnosis Chart.

#### Bearing Noise

Differential **side bearing** noise can easily be confused with wheel bearing noise. Since side bearings are preloaded, the noise should not diminish much when the differential (transaxle) is run with the wheels off the ground.

**Wheel bearings** produce a rough growl or grating sound. This sound will continue when the vehicle is coasting and the transaxle is in Neutral. Since these bearings are not preloaded, the noise should diminish considerably when the wheels are off the ground.

#### Brinelling

A brinelled bearing causes a "knock" or "click" approximately every two revolutions of the wheel because the bearing rollers do not travel at the same speed as the wheel.

Brinelling is caused by excessive thrust which pushes the balls up on the pathway and creates a triangular shaped dent or "Brinell" spot. Brinelling can also be caused by pressing the ring on a shaft or in a housing through the other ring.

False brinell occurs as a result of vibration outside of the area where the bearing is mounted. The condition is identified by slight brinell marks, giving a washboard effect in the ring. In operation, the effect is characterized by excessively noisy operation on a low note.

#### Lapping

Lapping is caused by fine particles of abrasive material such as scale, sand or emery which are circulated by oil and which cause wearing away of roller and race surfaces. Bearings which are worn loose, but remain smooth without spalling or pitting, are the result of dirty oil.

### Locking

Locking of bearings is caused by large particles of foreign material becoming wedged between rollers and race, usually causing one of the races to turn. Preloading of regular-type taper roller bearings, higher than specified, can also cause locking of bearings.

### Pitting

Pitting is a result of normal wear. This shows itself in the form of pitting on the rolling surface. Pitting may also result from some installation or operational conditions, such as indenting from foreign material.

### Spalling

Spalling is caused by overload or incorrect assembly. Spalled bearings have either flaked or pitted rollers or races. Incorrect assembly consists of misalignment, cocking of bearings, or adjustments that are too tight.

## Diagnosis Chart –Transaxle

| CONDITION | PROBABLE CAUSE |
|---|---|
| A knock at low speeds. | • Worn drive axle CV or TRI-POT joints.<br>• Worn side gear hub counterbore. |
| Noise most pronounced on turns. | • Differential gear noise. |
| Clunk on acceleration or deceleration. | • Loose engine mounts.<br>• Worn drive axle inboard TRI-POT joints.<br>• Worn differential pinion shaft in case.<br>• Side gear hub counterbore in case worn oversize. |
| Clicking noise in turns. | • Worn outboard CV joint. |
| Vibration. | • Rough wheel bearing.<br>• Bent drive axle shaft.<br>• Out-of-round tires.<br>• Tire unbalance.<br>• Worn CV joint in drive axle shaft.<br>• Incorrect drive axle angle (trim height). |
| Noisy in Neutral with engine running. | • Worn input gear bearings.<br>• Worn clutch release bearing. |
| Noisy in First only. | • Chipped, scored, or worn first-speed constant-mesh gears.<br>• Worn 1-2 synchronizer. |
| Noisy in Second only. | • Chipped, scored, or worn second-speed constant-mesh gears.<br>• Worn 1-2 synchronizer. |
| Noisy in Third only. | • Chipped, scored, or worn third-gear constant-mesh gears.<br>• Worn 3-4 synchronizer. |
| Noisy in Fourth only. | • Worn 3-4 gear synchronizer.<br>• Chipped, scored, or worn forth-gear or output gear. |
| Noisy in Fifth gear only. | • Worn 5th gear synchronizer.<br>• Chipped, scored, or worn fifth-speed gear or output gear. |

## Diagnosis Chart – Transaxle, Continued

| | |
|---|---|
| Noisy in Reverse only. | • Chipped, scored, or worn reverse idler gear, idler gear bushing, input or output gear(s). |
| Noisy in All gears. | • Insufficient lubricant.<br>• Worn bearings.<br>• Chipped, scored, or worn input gear (shaft) and/or output gear (shaft). |
| Slips out of gear. | • Worn or improperly adjusted linkage.<br>• Shift linkage does not work freely; binds.<br>• Bent or worn cables.<br>• Input gear bearing retainer broken or loose.<br>• Worn or bent shift fork. |
| Leaks lubricant. | • Fluid level indicator not seated in fill port, causing fluid leakage at vent plug.<br>• Worn axle shaft seals.<br>• Excessive amount of lubricant in transaxle.<br>• Loose or broken input gear (shaft) bearing retainer.<br>• Worn input gear bearing and/or lip seal damaged.<br>• Worn shift lever seal leaks.<br>• Lack of sealant between case and clutch cover or loose clutch cover. |

## Clutch Diagnosis

Before removal of the clutch hydraulic system, verify the malfunction by measuring the travel of the clutch slave cylinder push rod. With clutch pedal pushed fully to the floor stop, the slave cylinder push rod should travel 9.5 mm (0.374 inch) minimum, 11 mm (0.433 inch) on J-body, against the clutch release lever. Do not replace the hydraulic system if push rod travel exceeds this distance.

If the slave cylinder does not meet the travel requirements, check the reservoir fluid level. The slave cylinder must be in place when checking the fluid level.

The proper level is indicated by a step on the reservoir. Fill to the specified level with GM Delco Supreme No. 11 Brake Fluid or an equivalent fluid that meets DOT 3 specifications. Do not overfill.

**— NOTE —**

**Carefully clean the top and sides of the reservoir before opening to prevent contamination of the system with dirt, water or other foreign material. Remove the reservoir diaphragm before adding fluid. Carefully replace the diaphragm, cover gasket and cover after filling.**

If the reservoir requires any fluid, check the hydraulic system components for leakage. Remove the rubber boots from the cylinder and check for leakage past the pistons. A slight wetting of the surface is acceptable. Replace the system if excessive leakage is evident.

## Clutch Hydraulic Diagnosis Chart

| FAULT | CAUSE | ACTION |
|---|---|---|
| Pedal travels to floor. No pressure or very little resistance. | Master or slave cylinder faulty. Hose/ pipe burst or leaking. Connections leaking. No fluid in reservoir. | Check components and replace. Then bleed system. |
| Pedal travels to floor. No pressure or very little resistance. Fluid in master cylinder dust cover. | Rear seal failure in master cylinder. | Service or replace unit. Then bleed system. |
| Pedal travels to floor. No pressure or very little resistance. Fluid level in reservoir rises as pedal is depressed. | Master cylinder center valve seal faulty. | Service or replace unit. Then bleed system. |
| Fluid in area of master cylinder dust cover and on pedal. | Rear seal failure in master cylinder. | Service or replace unit. Then bleed system. |
| Fluid in slave cylinder and on cylinder body. | Slave cylinder plunger seal faulty. | Service or replace unit. Then bleed system. |
| Pedal feels "spongy" when depressed. | Air in system. | Check fluid level. Bleed system. Check and replace parts if symptom recurs. |
| Pedal effort high with long pedal travel. | Incorrect size master or slave cylinder fitted. | Check and fit correct unit. Then bleed system. |
| Unable to select gears. Pedal effort and travel normal. | Clutch mechanism faulty. Gearbox faulty. | Check and replace clutch or gearbox components. |
| Clutch slip. | Clutch plate worn. Master and/or slave cylinder seal worn or damaged. Overfilled reservoir. | Check and replace. Clean and service or replace units. Remove excess fluid. |
| Pedal effort and travel normal. Difficulty in selecting gears. | Clutch or gearbox mechanism faulty. Wear in clevis linkages. | Check and replace faulty or worn components. |

## Clutch Diagnosis Chart

| CONDITION | PROBABLE CAUSE | CORRECTION |
|---|---|---|
| Fails to release (Pedal pressed to floor – shift lever does not move freely in and out of reverse gear without gear clash. | • Improper pedal travel.<br>• Bent clutch pedal.<br>• Faulty driven disc.<br>• Fork and bearing not assembled properly.<br>• Clutch disc hub binding on input shaft splines.<br>• Clutch disc warped or bent.<br>• Clutch-to-flywheel bolts loose.<br>• Air in hydraulic system. | • Check for floor mat under pedal or misassembled bump stop.<br>• Replace pedal.<br>• Replace disc.<br>• Install properly and very lightly lubricate fingers at release bearing with wheel bearing grease.<br>• Repair or replace.<br>• Replace disc.<br>• Torque bolts to spec.<br>• Bleed air from system. |
| Slipping. | • Improper operation.<br>• Oil soaked driven disc.<br>• Worn facing or facing torn from disc.<br>• Warped pressure plate or flywheel.<br>• Weak diaphragm spring.<br>• Driven plate not seated in.<br>• Driven plate overheated. | • Correct as required.<br>• Install new disc and correct leak at its source.<br>• Replace disc.<br>• Replace pressure plate or flywheel.<br>• Replace pressure plate.<br>• Make 30 to 40 normal starts. CAUTION: Do Not Overheat<br>• Allow to cool. |
| Grabbing (chattering). | • Oil on facing. Burned or glazed facings.<br>• Worn splines on input shaft.<br>• Warped pressure plate or flywheel.<br>• Burned or smeared resin on flywheel or pressure plate. | • Install new disc and correct leak to engine or transaxle.<br>• Replace input shaft.<br>• Replace pressure plate or flywheel.<br>• Sand off if superficial. Replace burned or heat checked parts. |
| Rattling – transmission click. | • Release fork loose.<br>• Oil in driven plate damper.<br>• Driven plate damper spring failure.<br>• Low engine idle speed.<br>• Broken return spring in slave cylinder. | • Install properly.<br>• Replace driven disc.<br>• Replace driven disc.<br>• Adjust idle speed.<br>• Replace hydraulic system. |
| Release bearing noise with clutch fully engaged. | • Improper operation.<br>• Release bearing binding.<br>• Fork shaft improperly installed.<br>• Faulty bearing. | • Correct as required.<br>• Clean, relubricate, check for burrs, nicks, etc.<br>• Install properly.<br>• Replace bearing. |
| Noisy. | • Worn release bearing.<br>• Fork shaft improperly installed. | • Replace bearing.<br>• Install properly and lubricate fork fingers at bearing. |
| Pedal stays on floor. | • Bind in linkage or release bearing.<br>• Fork shaft binds in housing. | • Lubricate and free-up linkage and release bearing.<br>• Free-up shaft and lubricate. |
| Hard pedal effort. | • Driven plate worn.<br>• Fork shaft binds in housing.<br>• Worn pedal bushings. | • Replace driven plate.<br>• Free-up shaft and lubricate.<br>• Replace bushings. |

# 4. On-Car Service

## Clutch Hydraulic System Replacement

**— NOTE —**

**The clutch hydraulic system is serviced as a complete unit; it has been bled of air and filled with fluid. Individual components of the system are not available separately.**

### V6/2.8L ENGINE (A-, J- and L-Bodies)

#### Removal ...

1. Disconnect the negative cable from the battery.
2. Remove the air cleaner, mass airflow sensor and air intake duct as an assembly (A-body).
3. Disconnect the electrical lead at the washer bottle. Remove attaching bolts and washer bottle from the vehicle (A-body).
4. If equipped with cruise control, remove the mounting bracket retaining nuts from the strut tower (A-body).
5. Remove the hush panel from inside the vehicle.
6. Disconnect the clutch master cylinder push rod from the clutch pedal.
7. Remove the clutch master cylinder retaining nuts at front of dash.
8. Remove the slave cylinder retaining nuts at the transaxle.
9. Remove the hydraulic system as a unit from the vehicle.

#### Installation ...

1. Install the slave cylinder-to-transmission support bracket, aligning push rod into the pocket on the clutch fork outer lever. Tighten retaining nuts evenly to prevent damage to the slave cylinder. Torque nuts to specification.

   Do not remove the plastic push rod retainer from the slave cylinder. The straps will break on the first clutch pedal application.
2. Position the clutch master cylinder to the front of dash. Install the retaining nuts and tighten nuts evenly to prevent damage to the master cylinder. Torque nuts to specification.
3. Remove the pedal restrictor from the push rod. Lube push rod bushing on clutch pedal. Connect push rod to the clutch pedal and install the retaining clip.
4. If equipped with cruise control, check switch adjustment at clutch pedal bracket.

**— NOTE —**

**When adjusting cruise control switch, do not exert an upward force on the clutch pedal pad of more than 20 lbs. or damage to the master cylinder push rod retaining ring can result.**

5. Install hush panel.
6. Press the clutch pedal down several times. This will break the plastic retaining straps on the slave cylinder push rod. Do not remove the plastic button on the end of the push rod.
7. Install air cleaner, mass airflow sensor and air intake duct assembly (A-body).
8. Connect negative cable at battery.

## CLUTCH MASTER CYLINDER (P-BODY)

### Remove or Disconnect ...

1. Cylinder push rod at clutch pedal.
2. Hydraulic line at master cylinder.
3. Nuts attaching cylinder to cowl, remove cylinder.

### Install or Connect ...

1. Position cylinder push rod through cowl and loosely install cylinder to cowl nuts.
2. Cylinder push rod to clutch pedal with spring clip.

### Tighten ...

Torque cylinder-to-cowl nuts to 17 N·m (13 ft. lbs.).

### Install or Connect ...

1. Hydraulic line to master cylinder and torque to 17 N·m (13 ft. lbs.).
2. Fill clutch master cylinder with recommended fluid, bleed system.

## CLUTCH SLAVE CYLINDER (P-BODY)

### Remove or Disconnect ...

1. Hydraulic line at slave cylinder.
2. Slave cylinder-to-bracket bolts; remove slave cylinder.

### Install or Connect ...

1. Position slave cylinder at mounting bracket and pilot cylinder push rod into clutch release lever.
2. Slave cylinder-to-bracket nuts.

### Tighten ...

Torque nut to 22 N·m (16 ft. lbs.).

### Install or Connect ...

1. Hydraulic line to slave cylinder.

### Tighten ...

Torque line nut to 17 N·m (13 ft. lbs.).

### Install or Connect ...

1. Fill clutch master cylinder with recommended fluid and bleed system.

### Tighten ...

Torque nuts to 22 N·m (16 ft. lbs.).

## Master and Slave Cylinder Unit Repair

### CLUTCH MASTER CYLINDER (P-BODY)

**Remove or Disconnect ...**

See Figure 4-1 ...

1. Master cylinder as outlined.
2. Unscrew filler cap and drain surplus fluid. NEVER RE-USE FLUID BLED OR DRAINED FROM A SYSTEM.
3. Pull back dust cover.
4. Circlip together with retaining washer and push rod.
5. Shake cylinder to eject plunger assembly.
6. Lift leaf of spring retainer and remove spring assembly from plunger.
7. Compress spring to free valve stem from keyhole of spring retainer, thus releasing tension of spring.
8. Spring, valve spacer, spring washer from valve stem.
9. Valve seal from valve head.

**— NOTE —**

**Remove seal carefully from plunger ensuring no damage occurs to plunger surfaces.**

Replace all serviceable seals and parts and clean the remaining parts thoroughly with denatured alcohol and place them onto a clean sheet of paper.

Examine the bore of the cylinder for visible scores and ridges and check that it is smooth to the touch. If there is the slightest doubt as to the condition of the bore or the plunger, a new cylinder assembly must be used.

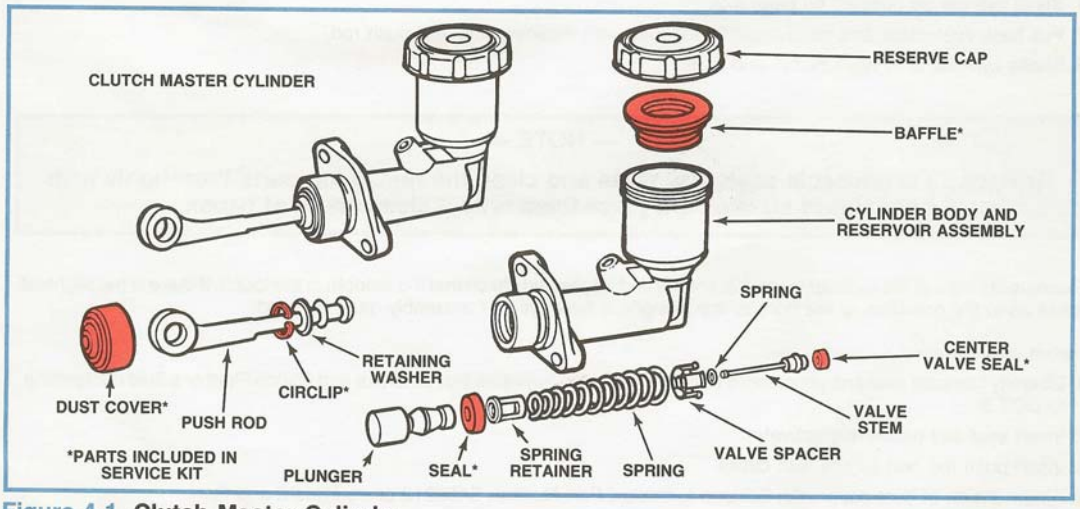



**Figure 4-1, Clutch Master Cylinder.**

**Install or Connect ...**

1. Fit plunger seal to plunger.
2. Fit valve seal, smallest diameter leading, to valve head.
3. Position spring washer on valve stem so that it flares away from valve stem shoulder (see Figure 4-1) follow with valve spacer, legs first, and spring.
4. Fit spring retainer to spring and compress spring until valve stem passes through keyhole slot and engages in center.
5. Fit spring immediately to plunger and press home leaf of spring retainer to secure.

**— NOTE —**

**Liberally lubricate the seal and the plunger bore with unused Delco Supreme No. 11 Brake and Clutch Fluid or a fluid conforming to DOT 3.**

6. Insert plunger assembly, valve end leading, into cylinder body, easing the entrance of the plunger seal.
7. Position push rod and retaining washer and fit circlip to secure.
8. Smear inside of dust cover with Silicone Lubricant Part Number 5459912 or equivalent and fit.
9. Fit cap washer.
10. Screw filler cap onto cylinder.
11. Remount cylinder.

## SLAVE CYLINDER (P-BODY)

**Remove or Disconnect ...**

See Figure 4-2 ...

1. Slave cylinder as outlined on page 4-2.
2. Pull back dust cover and remove circlip together with retaining ring and push rod.
3. Shake cylinder to remove piston and seal.

**— NOTE —**

**Replace all serviceable seals and parts and clean the remaining parts thoroughly with denatured alcohol and place them onto a clean sheet of paper.**

Examine the bore of the cylinder for visible scores and ridges and check that it is smooth to the touch. If there is the slightest doubt as to the condition of the bore or the plunger, a new cylinder assembly must be used.

**Install or Connect ...**

1. Liberally lubricate seal and piston bore with unused Delco Supreme No. 11 Brake and Clutch Fluid or a fluid conforming to DOT 3.
2. Insert seal and piston respectively.
3. Insert push rod and secure with circlip.
4. Smear inside of dust cover with Silicone Lubricant Part Number 5459912 or equivalent and fit.
5. Remount cylinder.

## Bleeding Hydraulic System

The process of removing air from the pipeline and cylinders is known as "bleeding" and is necessary whenever any part of the system has been disconnected, or level of fluid in the reservoir has been allowed to fall so low that air has been drawn into the master cylinder.

**— NOTE —**

**Never, under any circumstances, use fluid which has been bled from a system to fill the reservoir as it may be aerated, have too much moisture content and possibly be contaminated.**

1. Clean dirt and grease from the cap to ensure no foreign substances enter the system.
2. Remove cap and diaphragm and fill reservoir to the top with approved brake fluid only. (Brake fluid must be certified to DOT 3 specification.)
3. Fully loosen bleed screw which is in the slave cylinder body next to the inlet connection.
4. Fluid will now begin to move from the master cylinder down the tube to the slave. It is important that, for efficient gravity fill, the reservoir must be kept full at all times.
5. It will be noticeable at this point, that bubbles will appear at the bleed screw outlet. This means that air is being expelled. When the slave is full, a steady stream of fluid will come from the slave outlet. At this point, tighten bleed screw to a torque of 2 N·m.
6. Assemble diaphragm and cap to the reservoir; fluid in reservoir should be level with step.
7. The hydraulic system should now be fully bled and should release the clutch. Check vehicle by starting, pushing clutch pedal to the floor and selecting reverse gear. There should be no grating of gears; if there is, the hydraulic system still contains air. If this is the case, repeat bleed procedure.

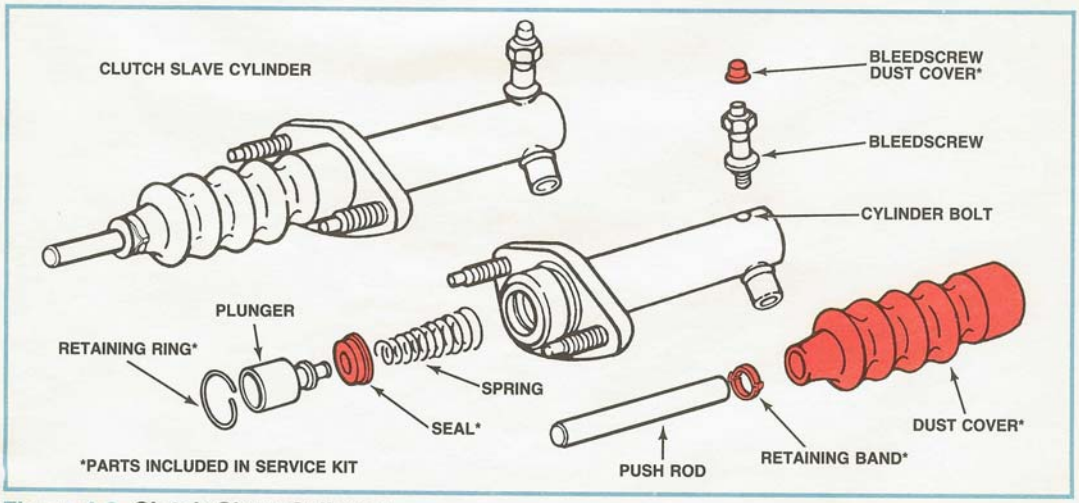



Figure 4-2, **Clutch Slave Cylinder.**

## Clutch Pedal Assembly Replacement

See Figure 4-3 ...

### Removal ...

1. Disconnect negative cable at the battery.
2. Remove the hush panel from inside the vehicle.
3. Disconnect the clutch master cylinder push rod from the clutch pedal.
4. Remove the clutch pedal pivot bolt and remove clutch pedal assembly from bracket.
5. Remove the spacer and bushings from the pedal.

### Installation ...

1. Install spacer and bushings on clutch pedal. Lubricate bushings before installing on clutch pedal.
2. Position clutch pedal to mounting bracket and install pivot bolt and retaining nut. Torque to specification.
3. Lube clutch master cylinder push rod bushing and then install on pedal.
4. Connect the clutch master cylinder push rod to the clutch pedal and install retaining clip. If equipped with cruise control, check switch adjustment at clutch pedal bracket.

**— NOTE —**

**When adjusting cruise control switch, do not exert an upward force on the clutch pedal pad of more than 20 lbs. or damage to master cylinder push rod retaining ring can result.**

5. Install hush panel.
6. Connect negative cable at battery.

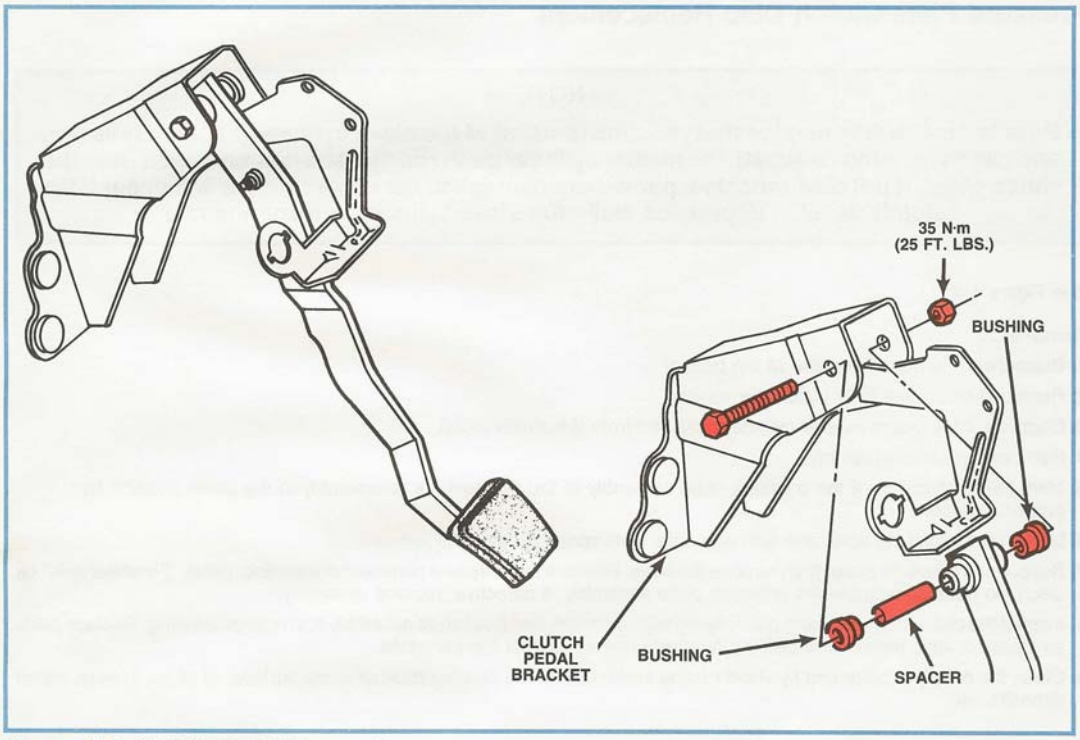



Figure 4-3, **Clutch Pedal Assembly.**

## Pressure Plate/Clutch Disc Replacement

**— NOTE —**

**Prior to any vehicle service that requires removal of the slave cylinder (i.e., transmission and clutch housing removal), the master cylinder push rod must be disconnected from the clutch pedal. If not disconnected, permanent damage to the slave cylinder will occur if the clutch pedal is depressed while the slave cylinder is disconnected.**

See Figure 4-4 ...

### Removal ...

1. Disconnect the negative cable at the battery.
2. Remove hush panel from inside the vehicle.
3. Disconnect the clutch master cylinder push rod from the clutch pedal.
4. Remove transaxle assembly.
5. Mark the relationship of the pressure plate assembly to the flywheel, for reassembly in the same position for proper balance.
6. Loosen the attaching bolts one turn at a time, until spring pressure is relieved.
7. Support the pressure plate, then remove the bolts. Remove the pressure plate and driven disc. (Note "Flywheel side" of disc.) Do not disassemble the pressure plate assembly. If defective, replace assembly.
8. Inspect the clutch disc, pressure plate, flywheel, clutch-fork and pivot shaft assembly and release bearing. Replace parts as required. Also inspect the bearing retainer outer surface of the transaxle.
9. Clean the pressure plate and flywheel mating surfaces and the bearing retainer outer surface, of all oil, grease, metal deposits, etc.

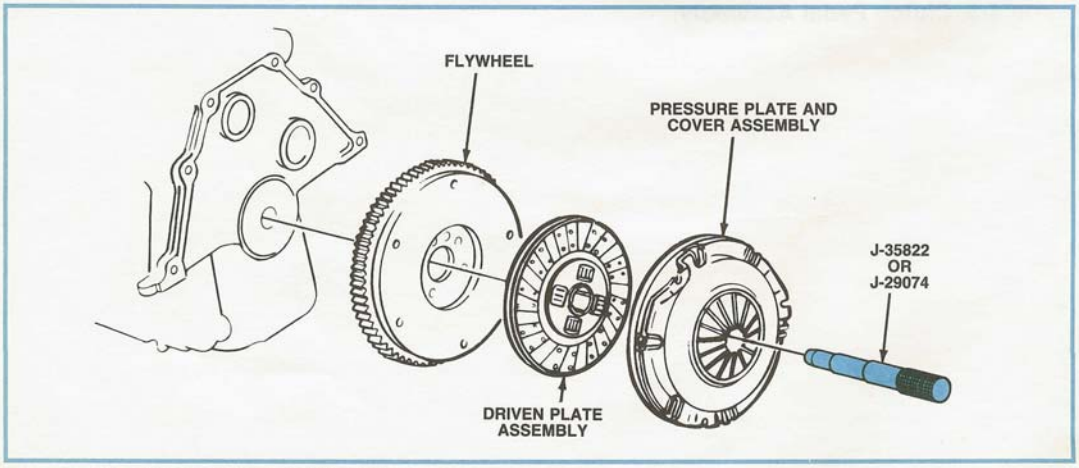



**Figure 4-4, Pressure Plate/Clutch Disc.**

### Installation ...

1. Position the clutch disc and pressure plate in relative installed position, and support with J-29074 or J-35822. The driven disc is installed with the damper springs offset toward the transaxle. Stamped letters on the driven disc identify "Flywheel side."
2. Install the pressure plate assembly-to-flywheel bolts evenly and gradually. Remove J-29074 or J-35822. Torque bolts to 20 N·m (15 ft. lbs.).
3. Lightly lubricate the clutch fork ends which contact the bearing and completely pack full the I.D. recess of the release bearing with grease P/N 1051344 or equivalent (Figure 4-5). On 5-speed transaxle, be sure bearing pads are located on fork ends (pads must be indexed) and both spring ends are in fork holes with the spring completely seated in bearing groove.

   Lightly lubricate the spline of the input shaft with grease P/N 1051344 or equivalent.
4. Install transaxle.

**— NOTE —**

**Clutch lever must not be moved toward flywheel until transaxle is bolted to the engine or damage to the transaxle could occur.**

5. Connect clutch master cylinder push rod to the clutch pedal and install the retaining clip.

   If equipped with cruise control, check switch adjustment at clutch pedal bracket.

**— NOTE —**

**When adjusting cruise control switch, do not exert an upward force on the clutch pedal pad of more than 20 lbs. or damage to master cylinder push rod retaining ring can result.**

6. Install hush panel.
7. Connect negative cable at the battery.

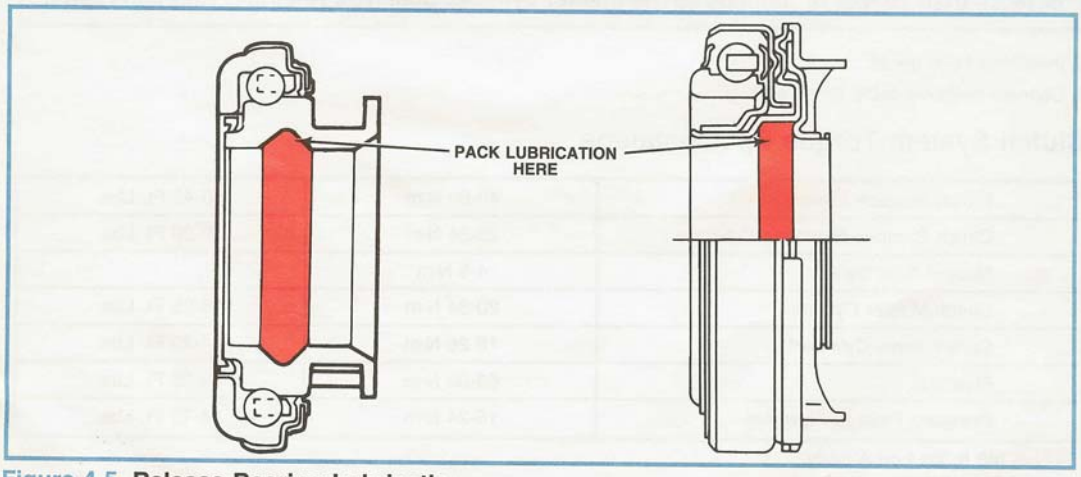



**Figure 4-5, Release Bearing Lubrication.**

## Flywheel Replacement

**— NOTE —**

**Prior to any vehicle service that requires removal of the slave cylinder (i.e., transmission and clutch housing removal), the master cylinder push rod must be disconnected from the clutch pedal. If not disconnected, permanent damage to the slave cylinder will occur if the clutch pedal is depressed while the slave cylinder is disconnected.**

See Figure 4-4 ...

### Removal ...

1. Disconnect negative cable at the battery.
2. Remove the hush panel from inside the vehicle.
3. Disconnect clutch master cylinder push rod from the clutch pedal.
4. Remove transaxle assembly.
5. Remove pressure plate and clutch disc assembly as previously outlined in this section.
6. Remove flywheel attaching bolts and flywheel assembly.

### Installation ...

1. Install flywheel and attaching bolts. Torque bolts to 70 N·m (50 ft. lbs.).
2. Install pressure plate, clutch disc assembly and release bearing as previously outlined in this section.
3. Install transaxle assembly.
4. Connect the clutch master cylinder push rod to the clutch pedal and install retaining clip.
   If equipped with cruise control, check switch adjustment at clutch pedal bracket.

**— NOTE —**

**When adjusting cruise control switch, do not exert an upward force on the clutch pedal pad of more than 20 lbs. or damage to the master cylinder push rod retaining ring can result.**

5. Install the hush panel.
6. Connect negative cable at the battery.

## Clutch System Torque Specifications

| | | |
|---|---|---|
| Clutch Release Lever | 40-60 N·m | 30-45 Ft. Lbs. |
| Clutch Pedal-to-Mounting Bracket | 28-34 N·m | 20-25 Ft. Lbs. |
| Neutral Start Switch | 4-5 N·m | |
| Clutch Master Cylinder | 20-34 N·m | 15-25 Ft. Lbs. |
| Clutch Slave Cylinder* | 18-26 N·m | 14-20 Ft. Lbs. |
| Flywheel | 60-80 N·m | 44-60 Ft. Lbs. |
| Pressure Plate to Flywheel | 18-24 N·m | 14-18 Ft. Lbs. |

*54 N·m (40 ft. lbs.) on A-body.

**Figure 4-6, SP-Specifications.**

## Transaxle Fluid Level Check

See Figure 4-7 ... Check the fluid level only when the engine is off, the vehicle is level, and the transaxle is cool enough to let you rest your fingers on the transaxle case. To check the fluid level, remove dipstick and read level indicated. When the dipstick indicates H, (hot) it is full when the transaxle is warm. If the dipstick indicates ADD or below, add fluid. Use 5W-30 (1052931) or equivalent lubricant to fill transaxle. Be sure the fluid level is between the H (hot) or C (cold) marks on the dipstick.

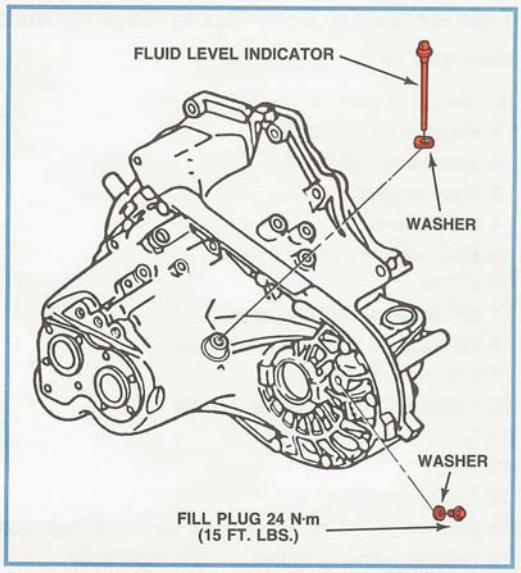



**Figure 4-7, Fluid Level Indicator/Fill Plug.**

## Shift Cable Adjustment (P-Body Only)

Only the shift cable is adjustable, and it is adjusted at the transaxle. Do not adjust the select cable.

See Figure 4-8 ...

### Adjust ...

1. Loosen nut on transaxle shift lever ball stud on shift cable only.
2. Place transaxle in third gear.
3. Screw and shift knob.
4. Front trimplate.
5. Shifter trimplate.
6. Pin floor shift mechanism in third gear.
7. Tighten nut 25 N·m (223 in. lbs.) on shift cable ball stud.
8. Install trim plates and shift knob.

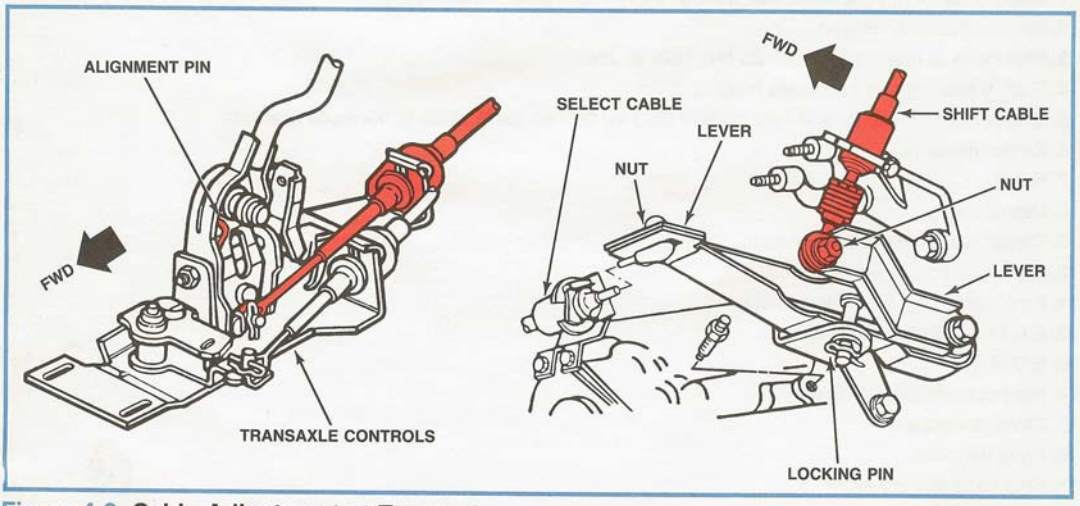



**Figure 4-8, Cable Adjustment at Transaxle.**

## Transmission Shift Cable Replacement (P-Body Only)

See Figure 4-9 ...

### Remove or Disconnect ...

1. Negative battery cable.
2. Screw and shift knob.
3. Front trimplate.
4. Shifter trimplate.
5. Rear console pad assembly.
6. E.C.M.
7. E.C.M. electrical connections.
8. Front carrier to I.P. reinforcement.
9. Carrier reinforcement.
10. Carpet clips and rivets at console.
11. Heater control.
12. Radio.
13. Carrier assembly.
14. Shift and select cable nuts from cable ball studs and transaxle brackets.
15. Release rubber grommet on cable from body.
16. Bolt and retainer securing shift cable to transaxle.
17. Retainers from select and shift cable.
18. Pull cables through body into passenger compartment.

### Install or Connect ...

1. Guide cable from passenger side through body into engine compartment.
2. Select cable with retainer.
3. Shift cable to retainer with bolt 25 N·m (223 in. lbs.).
4. Rubber grommet on cable and body.
5. Shift and select cables with nuts 25 N·m (223 in. lbs.) on cable studs to transaxle brackets.
6. Carrier assembly.
7. Radio.
8. Heater control.
9. Carpet clips and rivets at console.
10. Carrier reinforcements.
11. Front carrier to I.P. reinforcement.
12. E.C.M. electrical connection.
13. E.C.M.
14. Rear console pad assembly.
15. Shifter trimplate.
16. Front trimplate.
17. Shift knob and screw.
18. Negative battery cable.

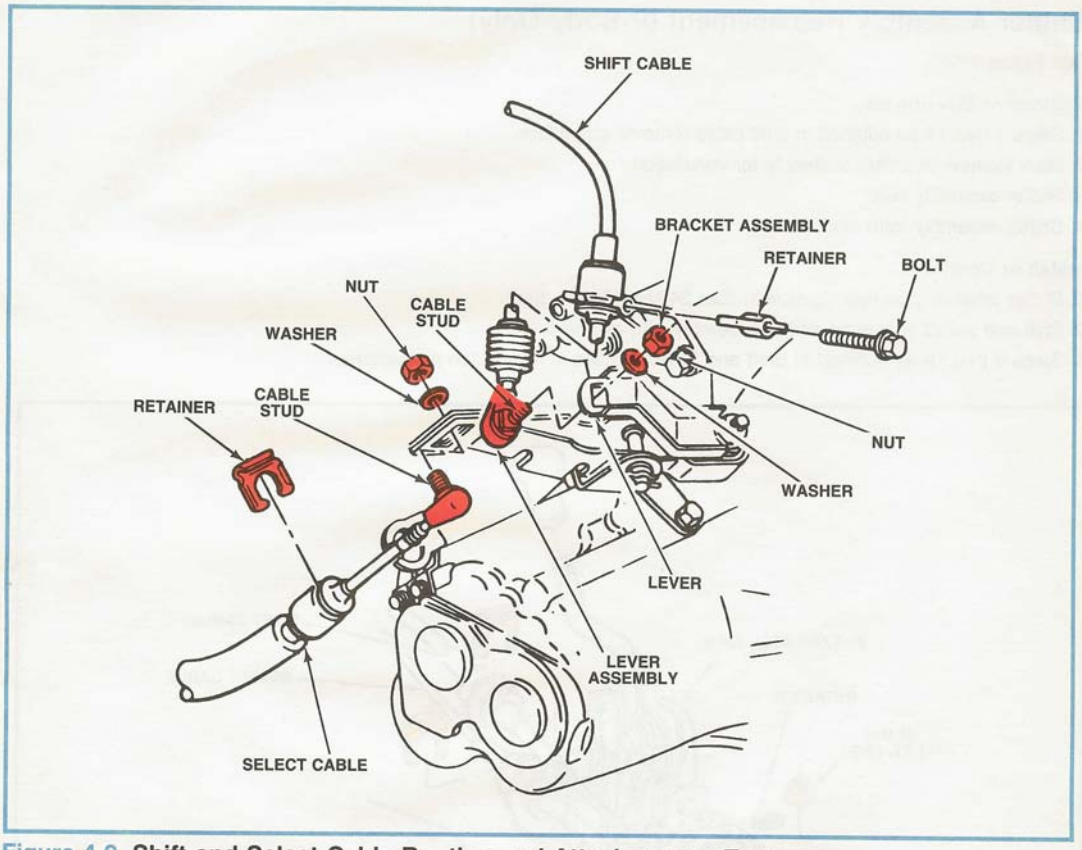



Figure 4-9, **Shift and Select Cable Routing and Attachment at Transaxle.**

## Shifter Assembly Replacement (P-Body Only)

See Figure 4-10 ...

### Remove or Disconnect ...

1. Steps 1 thru 14 as outlined in shift cable removal procedure.
2. Mark location of shifter assembly for installation.
3. Shifter assembly nuts.
4. Shifter assembly from studs.

### Install or Connect ...

1. Shifter assembly on four studs with nuts 24 N·m (214 in. lbs.).
2. Shift and select cables on shifter assembly with retainers.
3. Steps 6 thru 16 as outlined in Shift and Select Cables in installation procedures.

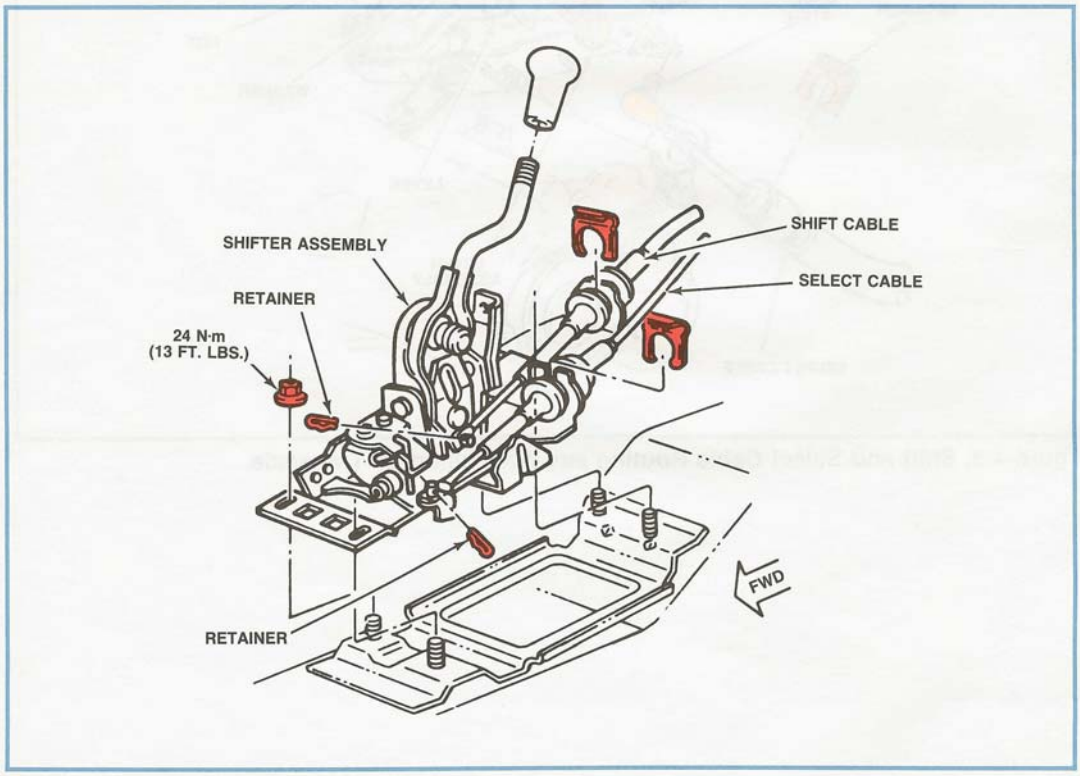



**Figure 4-10, Transaxle Control Assembly.**

## Transaxle Shift Levers and Brackets Replacement (P-Body Only)

See Figure 4-11 ...

### Remove or Disconnect ...

1. Select and shift cable nuts from cable studs.
2. Retainer from select cable.
3. Bolt and retainer from shift cable.
4. Bolt and bracket from select cable.
5. Nut and washer from manual shaft.
6. Shift cable lever from manual shaft .
7. Pin from collar and select cable lever.
8. Collar from manual shaft.
9. Pin and retainer from select cable lever.
10. Select cable lever.
11. Bolt from bracket and transaxle.

### Install or Connect ...

1. Bolt through bracket to transaxle.
2. Select cable lever on bracket.
3. Pin through select cable lever and bracket secured with retainer.
4. Collar over manual shaft with pin to select cable lever.
5. Shift cable lever on manual shaft with washer and nut 77 N·m (57 ft. lbs.).
6. Bracket with bolt 25 N·m (223 in. lbs.) to transaxle.
7. Retainer to select cable.
8. Bolt 25 N·m (223 in. lbs.) and retainer securing shift cable to transaxle.
9. Select and shift cable nuts 27 N·m (241 in. lbs.).

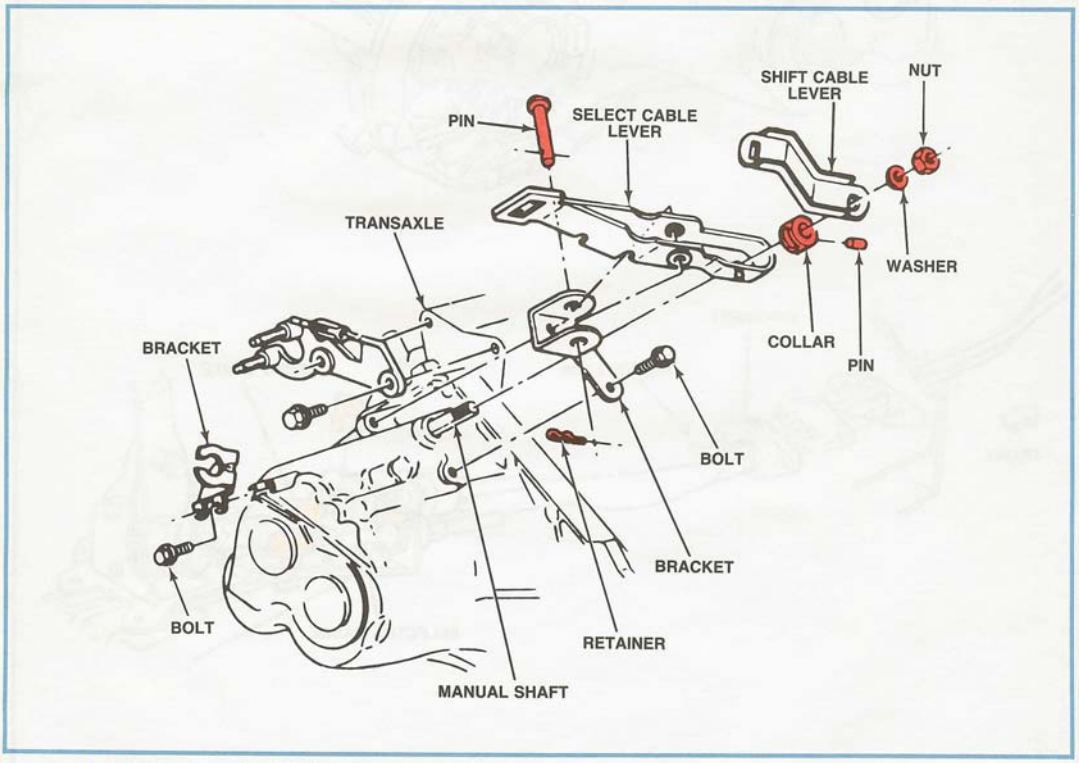



**Figure 4-11, Transaxle Shift Levers and Brackets.**

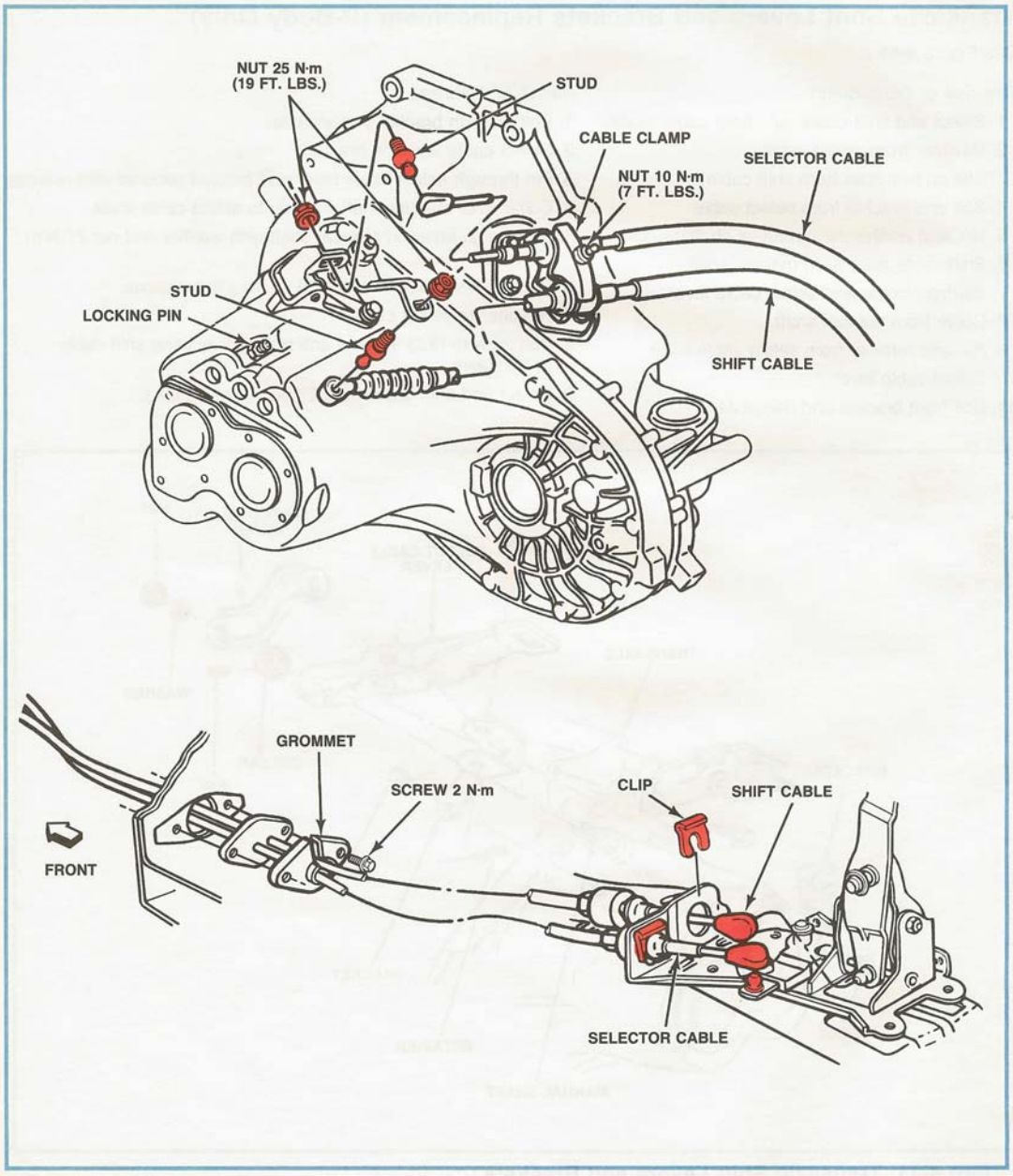



**Figure 4-12, Shift Cables.**

## Shift Cable Replacement (Except P-Body)

See Figure 4-12 ...

### Removal ...

1. Disconnect negative cable at battery.
2. Disconnect shift cables from the transaxle by removing cable clamp at the transaxle.
3. Remove cable ends from ball studs at shift levers by twisting a large flat blade screwdriver between nylon socket and lever.
4. Remove knob, console and shift boot.
5. Remove cable ends from the ball studs of the shifter by twisting a large flat blade screwdriver between nylon socket and shifter lever. Do not pry the socket off stud using the cable end for leverage.
6. Remove the spring clips holding the cables to the shifter base and remove cables from shifter.
7. Remove right front sill plate and pull carpet back to gain access to cables.
8. Remove cable grommet cover screws and cover at floor pan and remove cables.

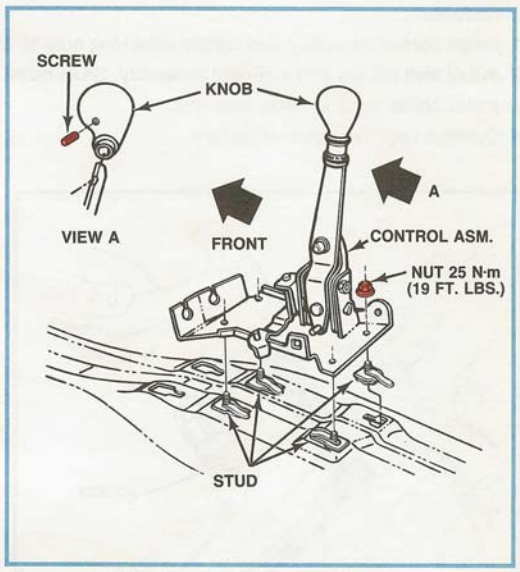



**Figure 4-13, Control Assembly.**

### Installation ...

1. Route cables and install cable grommet cover and attaching screws at floor pan.
2. Install shift cables at the control assembly. Snap cable ends onto the ball studs using channel locks.
3. Reposition carpet and install sill plate.
4. Raise vehicle.
5. Route cables to transaxle.
6. Lower vehicle.
7. Position cables and install retaining clamps at transaxle. Connect cables to shift levers.
8. Install shift boot, console and knob.
9. Connect negative cable at battery.

## Shifter Assembly Replacement (Except P-Body)

See Figure 4-13 ...

### Removal ...

1. Disconnect negative cable at battery.
2. Remove knob, console and shifter boot.
3. Remove cable ends from ball studs of shifter by twisting a large flat blade screwdriver between nylon socket and shifter lever. Do not pry the socket off stud using the cable end for leverage (Figure 4-12).
4. Remove spring clips holding cables to the shifter base and remove cables.
5. Remove control assembly.

### Installation ...

1. Install control assembly and tighten attaching nuts to 25 N·m (20 ft. lbs.).
2. Install shift cables at the control assembly. Snap cable ends onto the ball studs using channel locks.
3. Install shifter boot, console and knob.
4. Connect negative cable at battery.

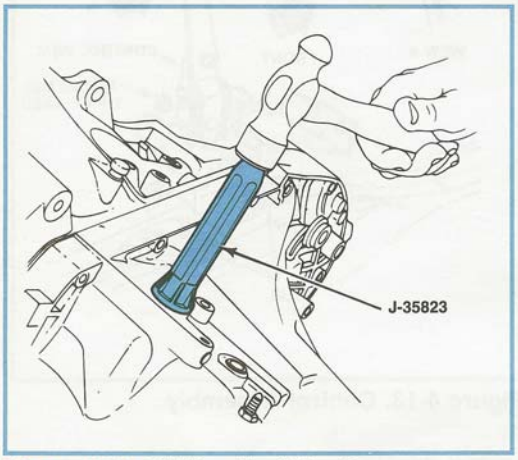



Figure 4-14, **Shifter Shaft Seal.**

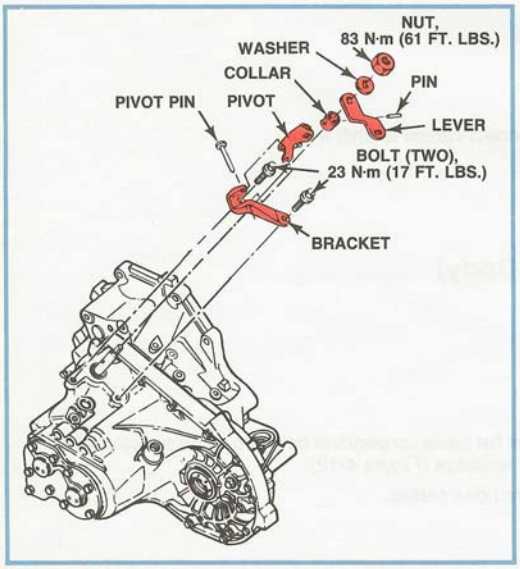



Figure 4-15, **Shift Linkage – FWD Shown.**

## Shift Shaft Seal Replacement

See Figures 4-14 and 4-15 ...

### Removal ...

1. Disconnect negative cable at battery.
2. Disconnect shift cables.
3. Remove the shift linkage:
   - Nut – Do not allow lever to move during removal of nut.
   - Washer
   - Lever
   - Pivot Pin
   - Pivot
   - Pin and Collar
   - Bolts
   - Bracket
4. Pry seal out of transaxle.

### Installation ...

1. Install seal using J-35823 and a hammer.
2. Install shift linkage by reversing the removal procedure.
   - Do not allow lever to move when tightening nut.
3. Connect shift cables.
4. Connect negative cable at battery.

## Transaxle Mount Replacement (A-Body)

See Figures 4-16 and 4-17 ...

### Removal ...

1. Disconnect negative cable at battery.
2. Install J-28467 engine support fixture. Attach fixture hook to engine lift ring and raise engine enough to take the pressure off the mounts (Figure 4-18).
3. Remove the mount nut-to-transaxle bracket.
4. Raise the engine to separate the mount from the bracket.
5. Raise the vehicle.
6. Remove the nuts retaining the mount to the cradle and remove the mount.

### Installation ...

1. Position the mount to the cradle and install retaining nuts. Torque to specification.
2. Lower the vehicle.
3. Lower the engine.
4. Install the mount-to-transaxle bracket retaining nut and torque to specification.
5. Remove J-28467 engine support fixture.
6. Connect negative cable to battery.

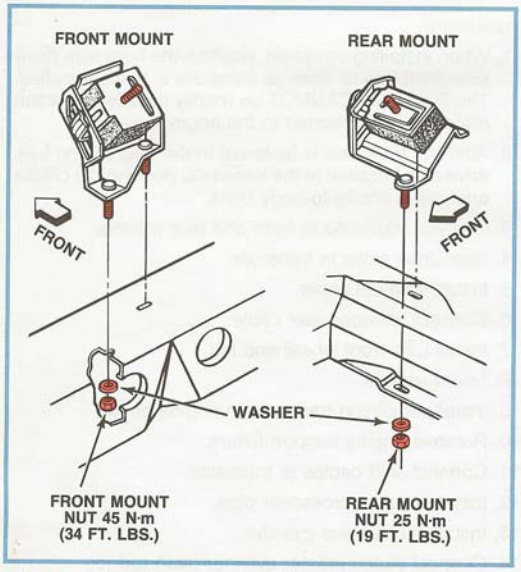



Figure 4-16, **Transaxle Mounts.**

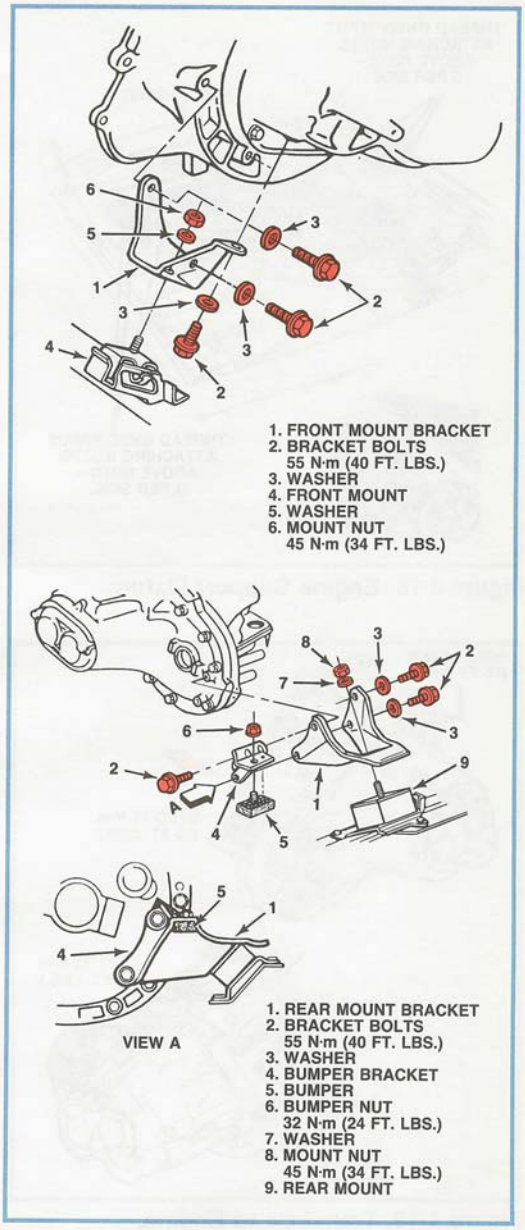



Figure 4-17, **Transaxle Mount Brackets.**

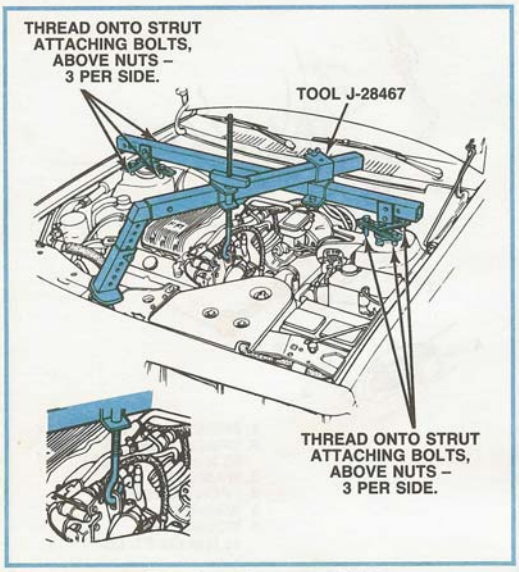



Figure 4-18, **Engine Support Fixture.**

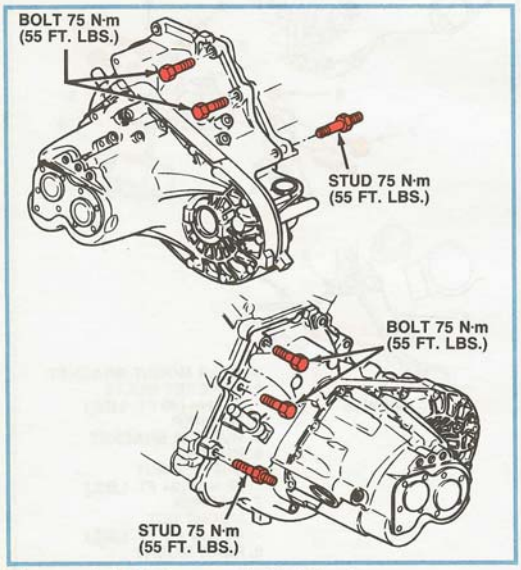



Figure 4-19, **Transaxle to Engine.**

## Transaxle Replacement (A-Body)

See Figures 4-18 and 4-19 ...

### Removal ...

1. Disconnect negative cable to battery.
2. Remove air cleaner and air intake duct assembly.
3. Remove hush panel from inside the vehicle.
4. Disconnect clutch master cylinder push rod from clutch pedal.
5. Disconnect clutch slave cylinder from transaxle.
6. Remove exhaust crossover pipe.
7. Disconnect shift cables at transaxle.
8. Install engine support fixture J-28467.
9. Remove top transaxle to engine bolts.
10. Raise vehicle and drain transaxle.
11. Install drive axle boot seal protectors.
12. Remove L.H. front wheel and tire.
13. Remove L.H. side cradle. Disconnect rear transaxle mount from the bracket.
14. Disengage R.H. and L.H. drive axles from transaxle.
15. Remove flywheel cover and disconnect speedometer cable.
16. Attach jack to transaxle case.
17. Remove retaining transaxle-to-engine bolts.

### Installation ...

1. When installing transaxle, position the right side drive axle shaft into its bore as transaxle is being installed. The R.H. shaft CANNOT be readily installed after the transaxle is connected to the engine.
2. After the transaxle is fastened to the engine and L.H. drive axle installed at the transaxle, position the cradle and install cradle-to-body bolts.
3. Connect transaxle to front and rear mounts.
4. Seat drive axles in transaxle.
5. Install flywheel cover.
6. Connect speedometer cable.
7. Install L.H. front wheel and tire.
8. Lower vehicle.
9. Install remaining transaxle-to-engine bolts.
10. Remove engine support fixture.
11. Connect shift cables at transaxle.
12. Install exhaust crossover pipe.
13. Install clutch slave cylinder.
14. Connect clutch master cylinder push rod to clutch pedal.

15. Install hush panel.
16. Install air cleaner and air intake duct assembly.
17. Fill transaxle with Manual Transaxle Oil #1052931 or equivalent.
    - Lube Capacity 1.9 Liters (2 quarts)

## Transaxle Mount Replacement (J-, N- and L-Body)

See Figure 4-20 ...

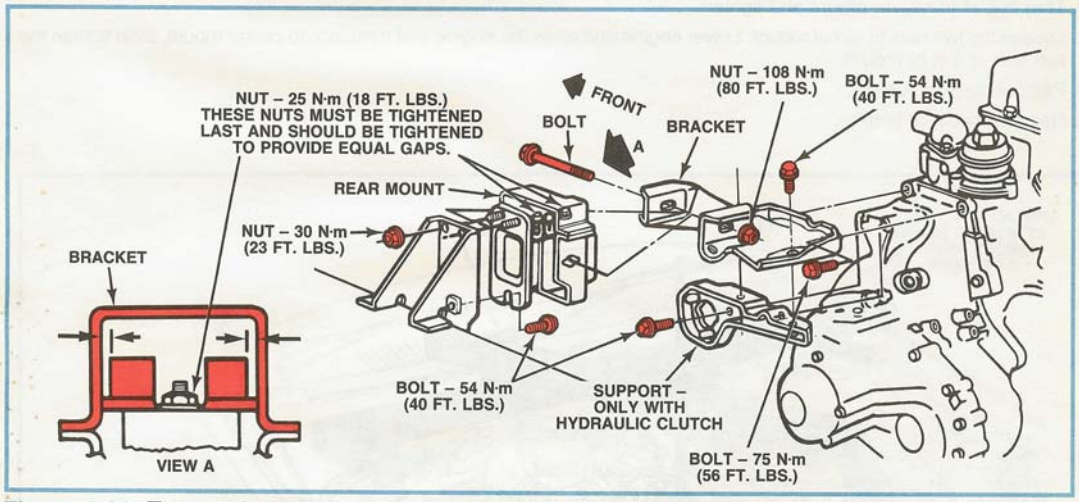



**Figure 4-20, Transaxle Mount.**

### Remove or Disconnect ...

Tool Required: J-28467 Engine Support Fixture.

1. Negative cable at battery.
2. Install engine support fixture (Figure 4-21). Raise engine to take pressure off the motor mounts.
3. Thru bolt at transaxle mount.
4. Bolts attaching transaxle mount to side frame.

### Install or Connect ...

1. Transaxle mount to side frame and install bolts.
2. Thru bolt at transaxle mount and tighten.
3. Loosen the two nuts at top of mount. Lower engine and allow the engine and transaxle to center mount, then tighten the two nuts at top of mount.
4. Remove engine support.
5. Negative cable at battery.

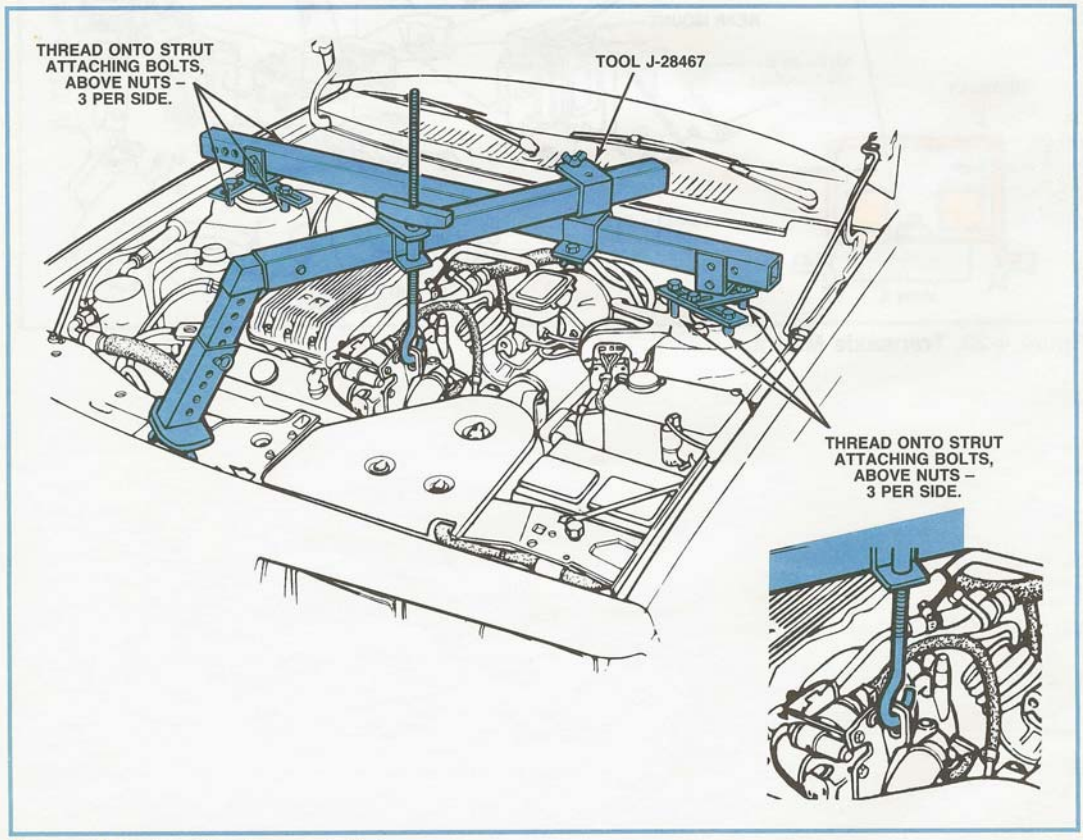



**Figure 4-21, Engine Support Fixture.**

## TRANSAXLE STRUT (J-, N- and L-Body)

See Figure 4-22 ...

### Remove or Disconnect ...

1. Negative cable at battery.
2. Raise car.
3. Bolts attaching strut to transaxle bracket and crossmember.
4. Strut.

### Install or Connect ...

1. Strut and attaching bolts.
2. Lower car.
3. Negative battery cable.

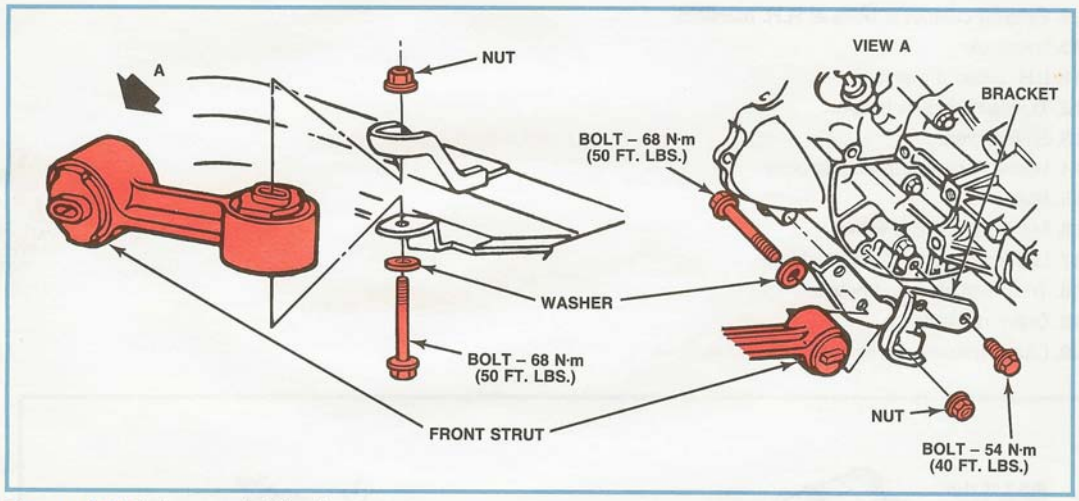



**Figure 4-22, Transaxle Strut.**

## Transaxle Replacement (J-, N- and L-Body)

See Figure 4-23 ...

### Remove or Disconnect ...

Tool Required: J-28467 Engine Support Fixture.

1. Negative cable at battery.
2. Install engine support fixture (Figure 4-21). Raise engine enough to take pressure off motor mounts.
3. Left sound insulator.
4. Clutch master cylinder push rod from clutch pedal.
5. Air cleaner and air intake duct assembly.
6. Clutch slave cylinder from transaxle support bracket and lay aside.
7. Transaxle mount thru bolt.
8. Raise car.
9. Exhaust crossover bolts at R.H. manifold.
10. Lower car.
11. L.H. exhaust manifold.
12. Transaxle mount bracket.
13. Shift cables.
14. Upper transaxle-to-engine bolts.
15. Raise car.
16. Left front tire and wheel.
17. Left front inner splash shield.
18. Transaxle strut and bracket.
19. Drain transaxle.
20. Clutch housing cover bolts.

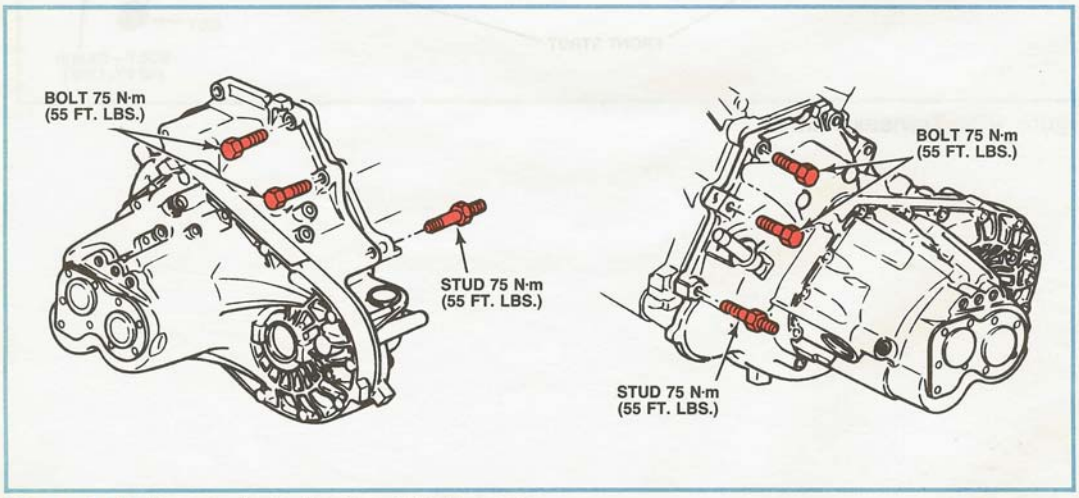



Figure 4-23, **Transaxle-to-Engine Attachments.**

21. Speedometer cable.
22. Stabilizer bar at left suspension support and control arm.
23. Ball joint from steering knuckle.
24. L.H. suspension support attaching bolts and remove the support and control arm as an assembly.
25. Drive axles at transaxle and remove L.H. shaft from transaxle.
26. Attach transaxle case to jack.
27. Remaining transaxle-to-engine bolts.
28. Transaxle by sliding toward the drive side away from engine. Carefully lower jack guiding R.H. drive axle out of transaxle.

**Install or Connect ...**

1. When installing transaxle, guide the right drive axle into its bore as the transaxle is being raised. The R.H. drive axle CANNOT be readily installed after the transaxle is connected to engine.
2. Transaxle to engine mounting bolts, and tighten to specifications.
3. Left drive axle into its bore at transaxle and seat both drive axles at transaxle.
4. Suspension support-to-body bolts.
5. Ball joint to steering knuckle.
6. Stabilizer bar to suspension support and control arm.
7. Speedometer cable.
8. Clutch housing cover bolts.
9. Strut bracket to transaxle.
10. Strut.
11. Inner splash shield.
12. Tire and wheel assembly and torque wheel nuts.
13. Lower car.
14. Upper transaxle to engine bolts.
15. Shift cables.
16. Transaxle mount bracket.
17. L.H. exhaust manifold.
18. Raise car.
19. Exhaust crossover bolts at R.H. manifold.
20. Lower car.
21. Transaxle mount thru bolt.
22. Clutch slave cylinder to support bracket.
23. Air cleaner and air intake duct assembly.
24. Remove engine support fixture.
25. Clutch master cylinder push rod to clutch pedal.
26. Left sound insulator.
27. Negative cable at battery.

**Adjust ...**

- Fluid level
  - Manual Transaxle Oil #1052931 or equivalent.
  - Capacity 1.9 Liters (2 quarts)

## Rear Transaxle Mount Replacement (P-Body)

See Figure 4-24 ...

### Remove or Disconnect ...

1. Disconnect negative battery cable.
2. Remove two nuts and wire harness from studs attaching lower half of transaxle mount to frame.
3. Install J-28467, J-35563, J-28467-60 (GT only), engine support fixture. Attach fixture hook to engine lift ring and raise engine enough to take the pressure off the mount (Figure 4-26).
4. Four bolts attaching rear transaxle mount to transaxle.
5. Nut from stud connecting upper and lower halves of mount.

### Install or Connect ...

1. Nut 48 N·m (35 ft. lbs.) connecting upper and lower mount halves.
2. Four bolts attaching rear transaxle mount 55 N·m (41 ft. lbs.).
3. Lower engine and remove tools J-28467, J-35563, and J-28467-60.
4. Two nuts and wire harness 48 N·m (35 ft. lbs.) attaching rear transaxle mount to frame.
5. Negative battery cable.

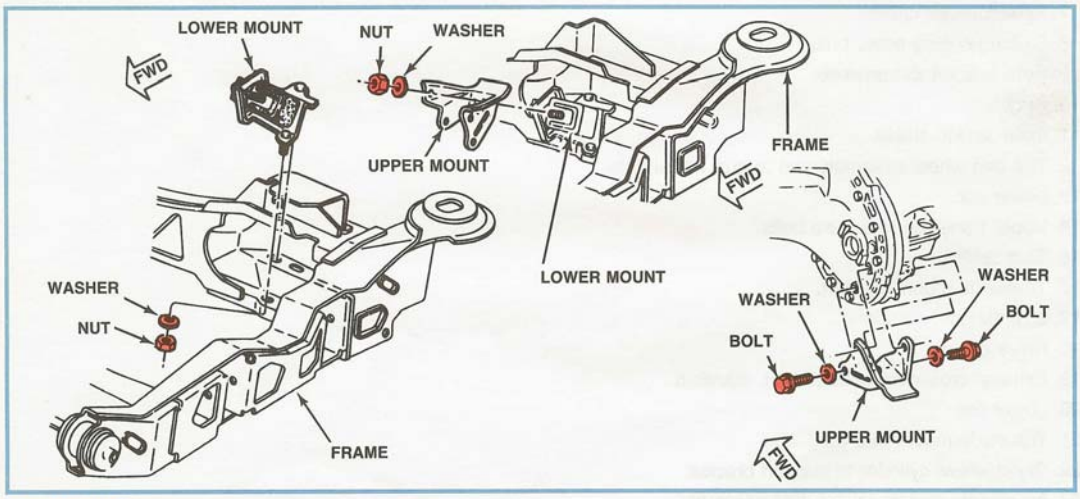



**Figure 4-24, Rear Transaxle Mount.**

## Front Transaxle Mount Replacement (P-Body)

See Figure 4-25 ...

### Remove or Disconnect ...

1. Negative battery cable.
2. Two bolts attaching upper half of transaxle mount.
3. Nut from stud attaching coolant pipe to stud and stud from mount.
4. Install J-28467, J-35563, and J-28467-60 (GT only), engine support fixtures. Attach fixture hook to engine lift ring and raise enough to take the pressure off the mounts.
5. Two nuts from studs attaching lower half of mount to frame and remove mount.
6. Nut from stud attaching rear transaxle upper and lower halves.

### Install or Connect ...

1. Nut on stud 48 N·m (35 ft. lbs.) attaching upper and lower halves of transaxle mount.
2. Upper half of transaxle mount with stud 54 N·m (40 ft. lbs.) and coolant pipe over stud.
3. Two bolts and one nut on stud 54 N·m (40 ft. lbs.) attaching upper half of transaxle mount to transaxle.
4. Lower engine and remove tools J-28467, J-35563, and J-28467-60.
5. Two nuts on studs 48 N·m (35 ft. lbs.) attaching lower half of transaxle mount to frame.
6. Negative battery cable.

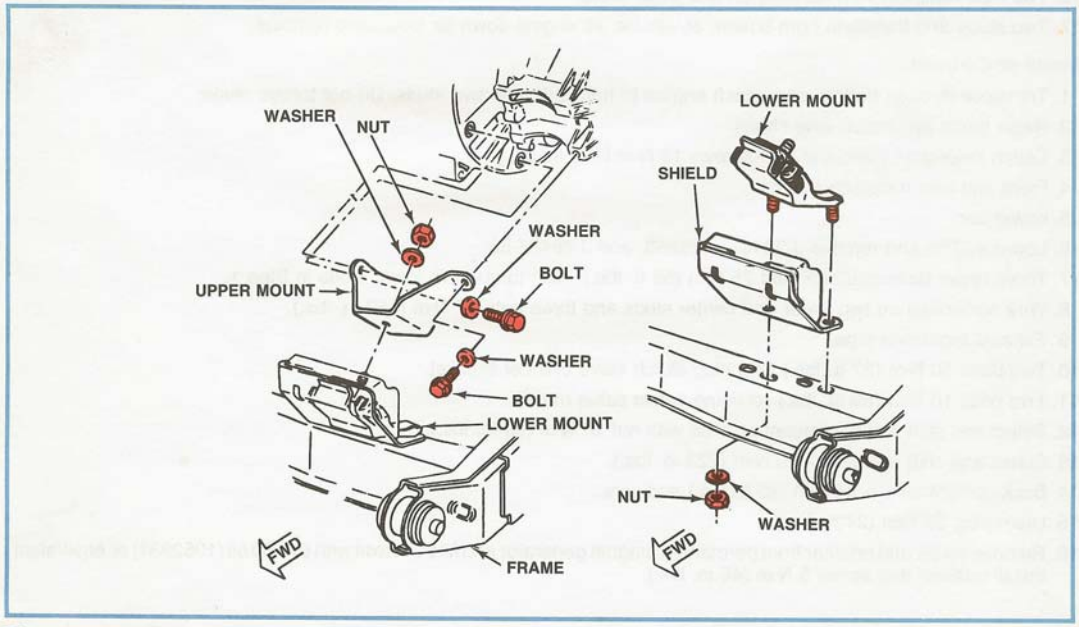



**Figure 4-25, Front Transaxle Mount.**

## Transaxle Replacement (P-Body)

### Remove or Disconnect ...

1. Drain plug and drain transaxle.
2. Select and shift cable nuts securing cables to transaxle brackets.
3. Back-up light switch wire and switch.
4. Shift cables and nut on stud securing bracket to transaxle.
5. Two bolts securing select cable mount.
6. Two bolts attaching clutch slave cylinder bracket.
7. Exhaust crossover pipe.
8. Nut, clip and wire from center stud.
9. Three upper bolts and one stud attaching transaxle to engine.
10. Install J-28467, J-35563, J-28467-60 (GT only), engine support fixtures. Attach fixture hook to engine lift ring and raise engine enough to take the pressure off the mounts (Figure 4-26).
11. Front and rear transaxle mounts.
12. Raise car.
13. Four clutch inspection plate screws and inspection plate.
14. Lower frame and tilt.
15. Remove axle shafts.
16. Two nuts retaining wire harness on two lower studs.
17. Two studs and transaxle from bottom of vehicle, tilt engine down for clearance removal.

### Install or Connect ...

1. Transaxle through bottom and attach engine to transaxle with two studs. Do not torque studs.
2. Raise frame and install axle shafts.
3. Clutch inspection plate and four screws 13 N·m (116 in. lbs.).
4. Front and rear transaxle mounts.
5. Lower car.
6. Lower engine and remove J-28467, J-35563, and J-28467-60.
7. Three upper bolts and one stud 75 N·m (55 ft. lbs.). Also torque two lower studs in Step 1.
8. Wire harnesses on two lower and center studs and three nuts 17 N·m (152 in. lbs.).
9. Exhaust crossover pipe.
10. Two bolts 50 N·m (27 ft. lbs.) attaching clutch slave cylinder bracket.
11. Two bolts 10 N·m (89 in. lbs.) retaining select cable mount.
12. Select and shift cable to mount on stud with nut 10 N·m (89 in. lbs.).
13. Select and shift cables nut 25 N·m (223 in. lbs.).
14. Back-up light switch 34 N·m (25 ft. lbs.) and wire.
15. Drain plug 33 N·m (24 ft. lbs.).
16. Remove screw and retainer from permanent magnet generator and fill transaxle with 5W-30 oil (1052931) or equivalent. Install retainer and screw 5 N·m (45 in. lbs.).

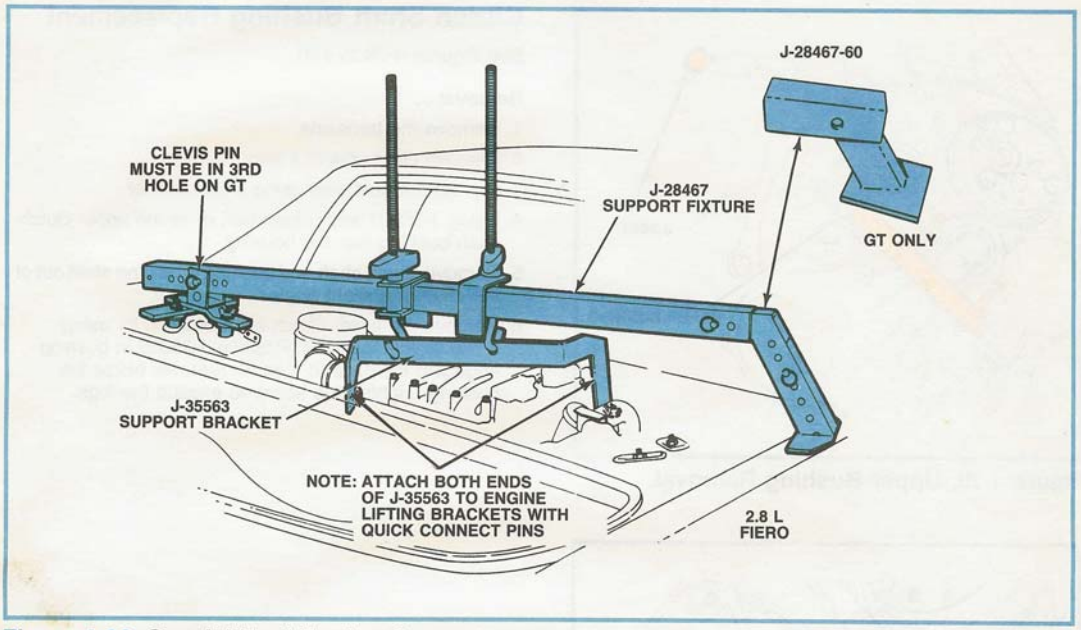



**Figure 4-26, Special Tool Engine Support.**

## Drive Axle Seal Replacement

See Figure 4-27 ...

### Removal ...

1. Disconnect negative cable at battery.
2. Remove drive axle.
3. Remove seal from transaxle.

### Installation ...

1. Using J-26938 with J-8092, drive seal into seal bore in case.
2. Install drive axle.
3. Check fluid level and adjust as required.
4. Connect negative cable at battery.

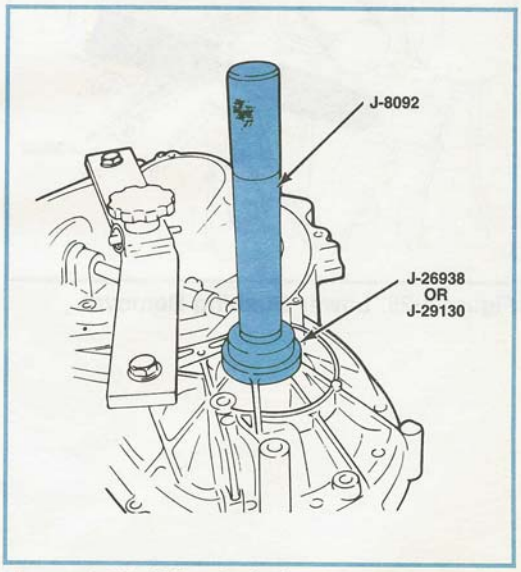



**Figure 4-27, Drive Axle Seal.**

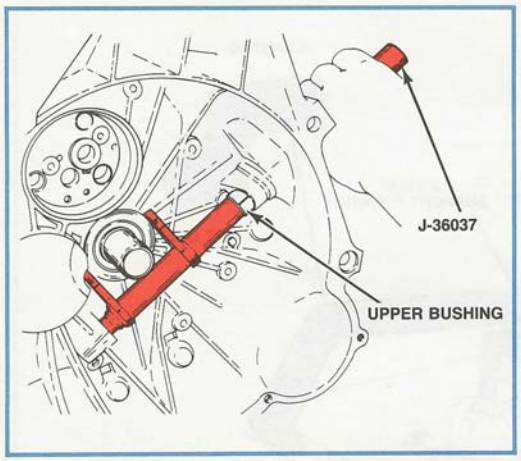



Figure 4-28, **Upper Bushing Removal.**

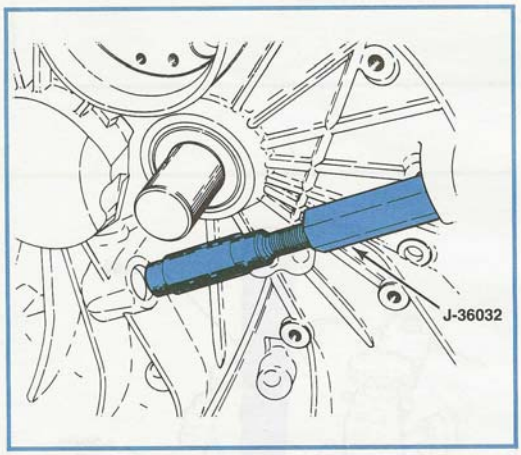



Figure 4-29, **Lower Bushing Removal.**

## Clutch Shaft Bushing Replacement

See Figures 4-28 to 4-31 ...

### Removal ...

1. Remove the transaxle.
2. Remove clutch release lever.
3. Pry out the dust seal using a screwdriver.
4. Using J-36037 and a hammer, drive the upper clutch shaft bushing into the housing.
5. Remove clutch shaft and bushing by sliding shaft out of the case at a slight angle.
6. Remove the lower clutch shaft bushing by using J-36032 with J-23907. Position J-36032 in bushing engaging the second step on remover below the bushing. Tighten the screw to expand the legs.

**Installation ...**

1. Install lower bushing using J-36033 with J-36190.
2. Install clutch shaft.
3. Slide upper bushing down clutch shaft.
4. Using J-36037 and a hammer, drive bushing into housing until the line on J-36037 is flush with housing surface.
5. Install dust seal.
6. Install clutch release lever.
7. Install transaxle.

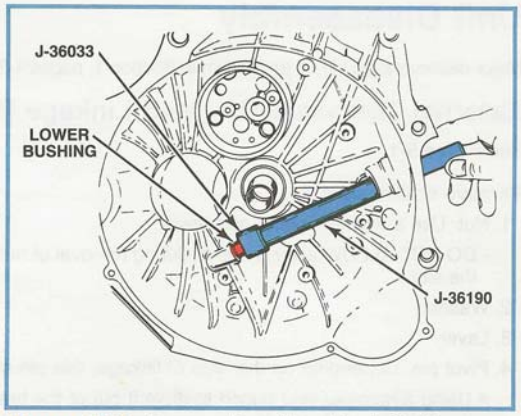



**Figure 4-30, Lower Bushing Installation.**

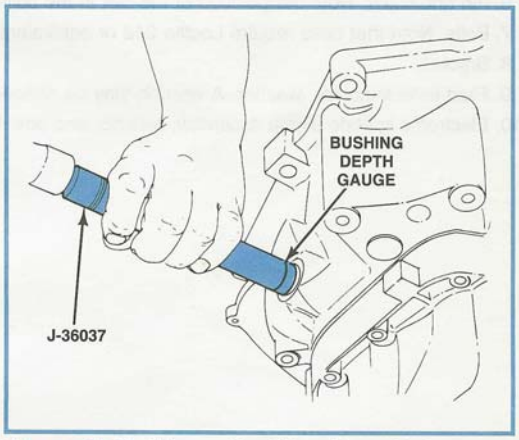



**Figure 4-31, Upper Bushing Installation.**

# 5. Unit Overhaul

## Unit Disassembly

Major disassembled views are shown in Section 1, pages 1-34 to 1-37.

### External Transaxle Mounted Linkage Removal

See Figure 5-1 ...

#### Remove or Disconnect ...

1. Nut. Use a 21 mm socket and driver.
   - DO NOT ALLOW lever to move during removal of nut. Use a 3/8-in. drive ratchet to hold the external shift lever by the slot.
2. Washer.
3. Lever.
4. Pivot pin. Depending on the type of linkage, this pin may be removed by:
   - Using a hammer and punch to drive it out of the bracket (replace with P/N 14091786).
   - Removing a retaining clip and sliding the pin out of the bracket (may be re-used).
5. Pivot. Use a 3/16-in. punch and hammer.
6. Pin and collar. Note the position of the slot in the collar for installation.
7. Bolts. Note that bolts require Loctite 242 or equivalent for installation.
8. Bracket.
9. Fluid level indicator, washer. A wrench may be needed to loosen the fluid level indicator. This is a **must** to do!
10. Electronic speedo signal assembly, retainer and bolt. Use a 10 mm socket and driver.

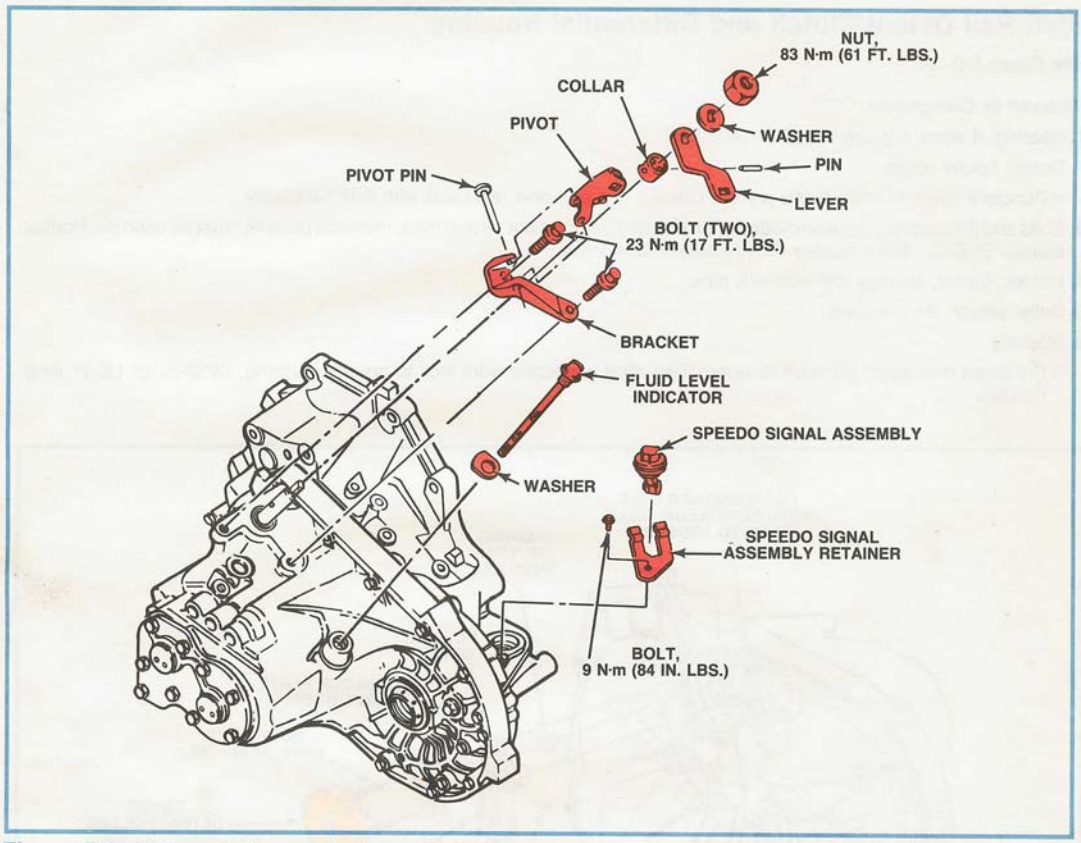



**Figure 5-1, External Transaxle Mounted Linkage.**

## Shift Rail Detent/Clutch and Differential Housing

See Figure 5-2 ...

**Remove or Disconnect ...**

1. Bearing. If worn, replace with P/N 14080591.
2. Detent holder cover.
   - Puncture cover in middle and pry off. Discard this part and replace it with P/N 14082039.
3. Bolts and interlock plate (early models) (B). If detent holder is not 18 mm thick, interlock plate kit must be used per Pontiac bulletin 86-C-07. Bolts require 10 mm socket and driver.
4. Holder, detent, springs and interlock pins.
5. Balls, detent. Do not lose!
6. Bushing.
   - Pry loose (two small pry bars in slots). Two allen wrenches work well to pry this bushing. (3/32-in. or 1/8-in. long handle).

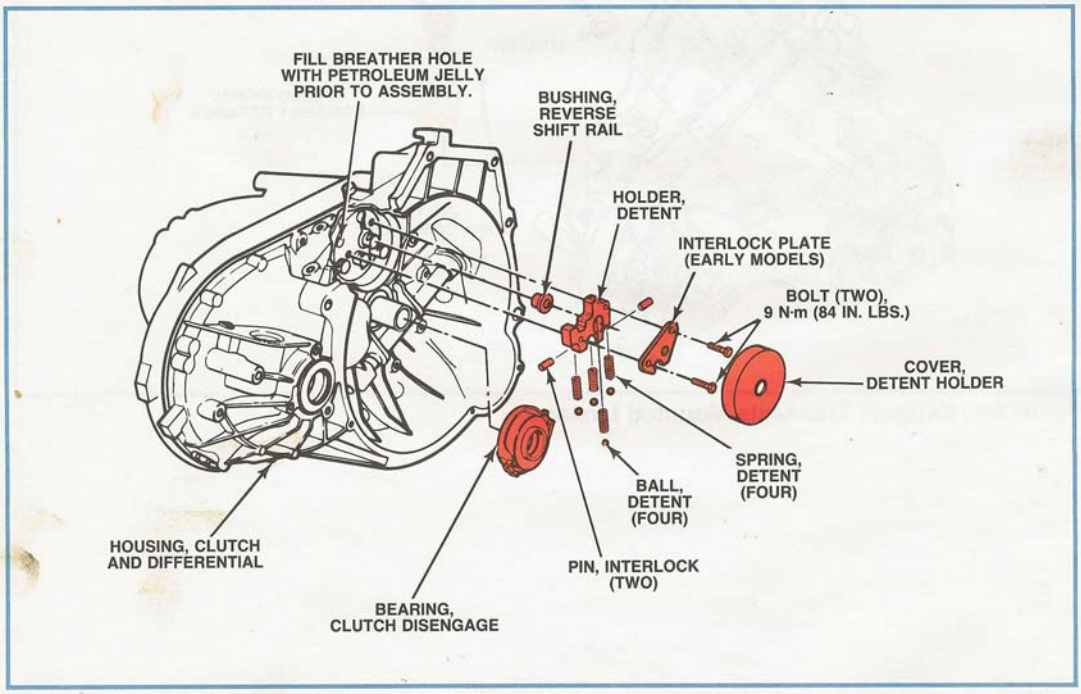



**Figure 5-2, Shift Control Components/Clutch and Differential Housing.**

## Shift Shaft Detent/Transmission Housing

See Figure 5-3 ...

**Remove or Disconnect ...**

1. Snap ring, using a screwdriver.
2. Cover, using a soft-faced hammer, replace with P/N 14080595.
3. Screw and outer spring seat using a 5 mm bit and driver.
4. Fifth/Rev. bias spring and inner spring seat.

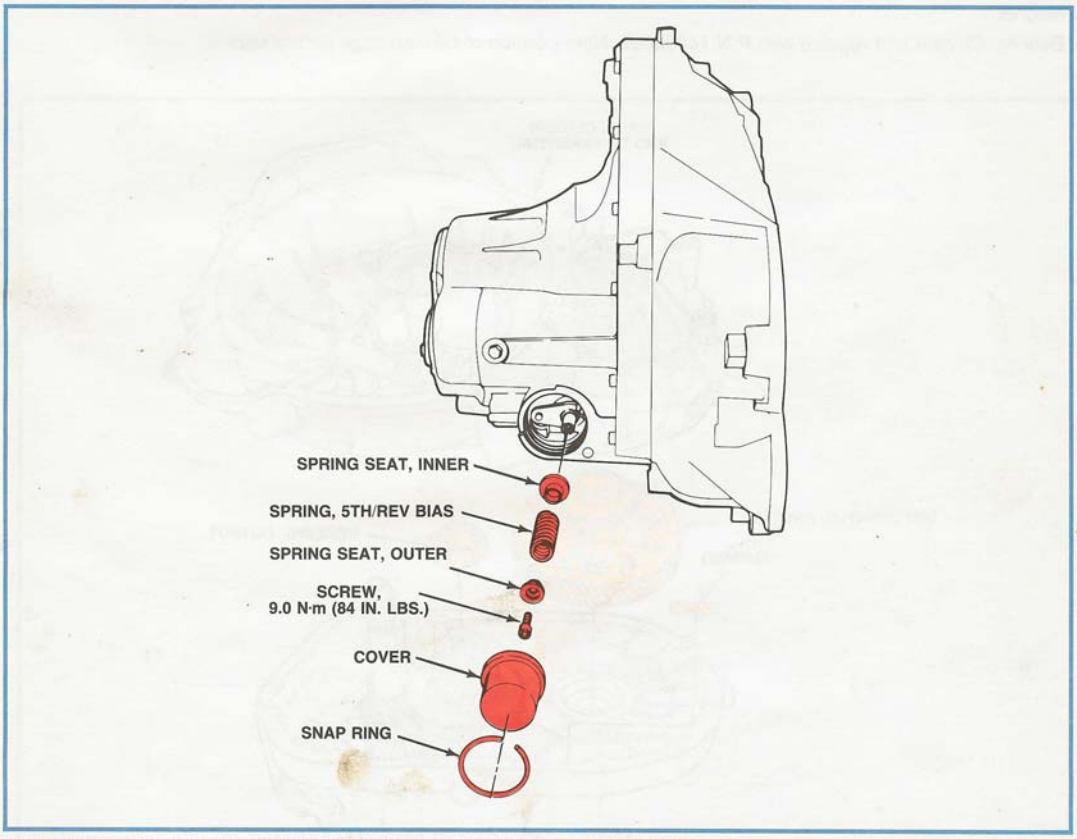



**Figure 5-3, Shift Shaft Detent Components/Transmission Housing.**

## Transmission Case and Clutch Housing Separation

See Figure 5-4 ...

### Remove or Disconnect ...

1. Bolts, using a 13 mm socket and driver.
2. Clutch housing, using a soft-faced hammer.
   Remove the Loctite 518 anaerobic sealer with either a liquid gasket remover or J-28410 scraper.
   The sealer is available from GMWWD, P/N 1052942 for 0.20 fluid ounces.
3. Differential gear assembly. Support the transmission case on a workbench top, being careful to support it properly.
4. Magnet.
5. Bearing. Discard and replace with P/N 14092035. Note position of bearing cage for installation.

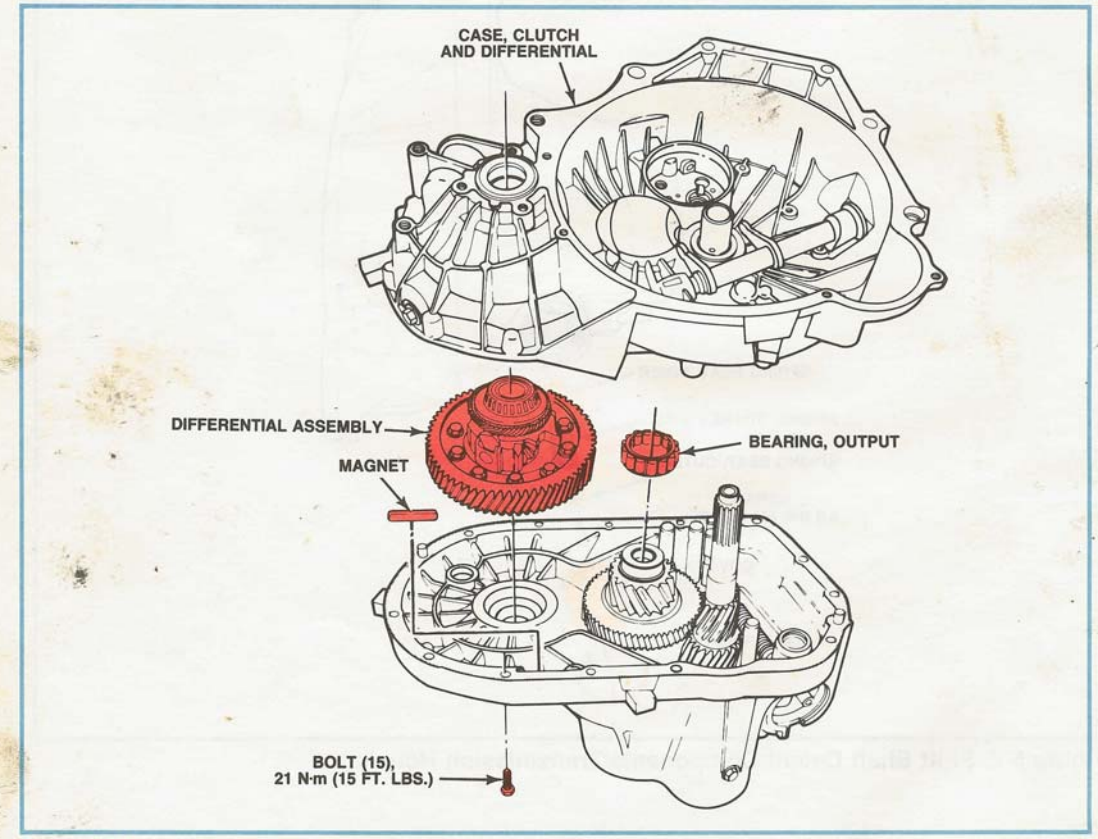



**Figure 5-4, Clutch and Transmission Housing Components.**

## Shift Shaft Components

See Figures 5-5 and 5-6 ...

### Remove or Disconnect ...

1. Pin. Use a size 3/16-in. punch and hammer.
   - Pin may fall into case.
2. Shift shaft assembly.
   - Shaft, rollers (take care not to lose detent rollers) and pins.
   - 1st/2nd bias spring.
   - Shift lever.
   - Reverse lever.

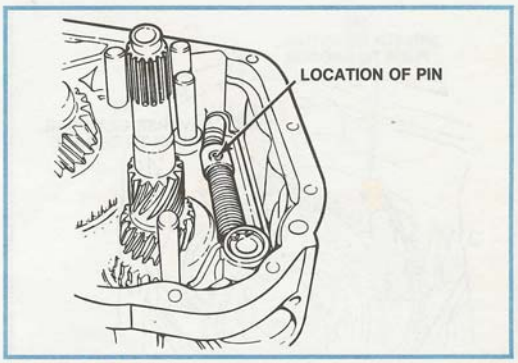



Figure 5-5, **Shift Lever Pin Removal.**

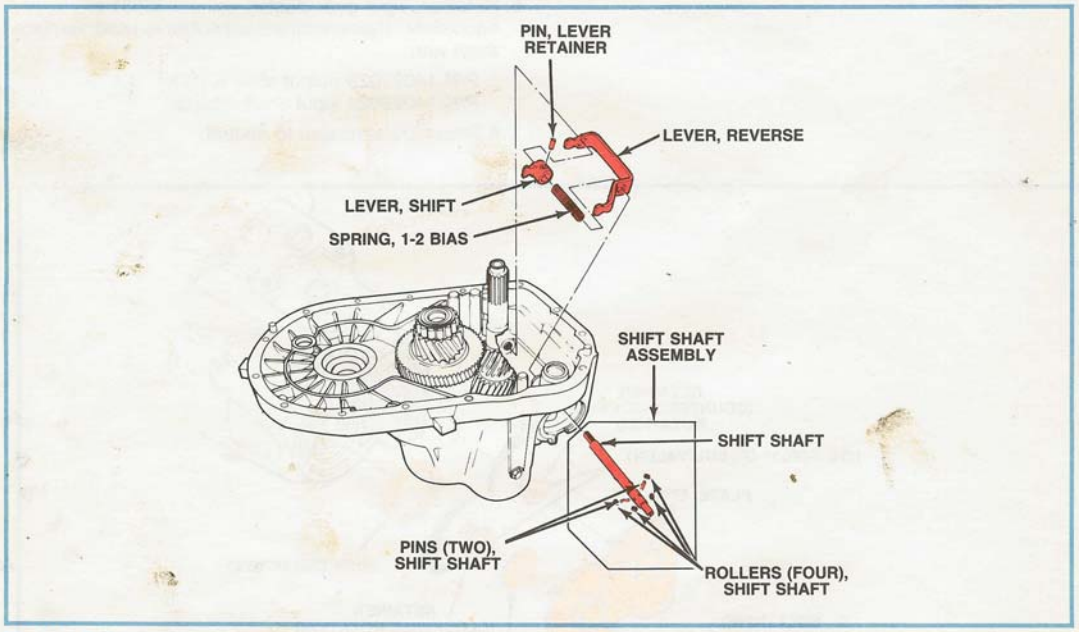



Figure 5-6, **Shift Shaft Components.**

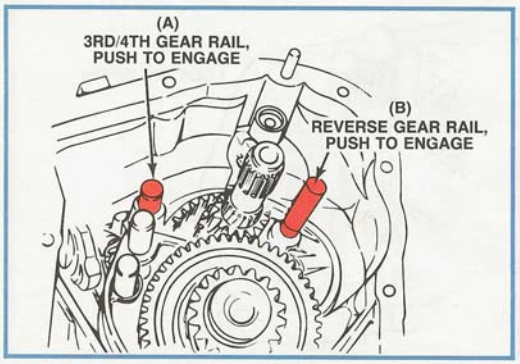



Figure 5-7, **Engage Fourth and Reverse.**

## Gear Cluster Support Components

See Figures 5-7 and 5-8 ...

### Remove or Disconnect ...

Tool Required – J-36031 Bearing Retainer Bolt Hex Socket or equivalent.

- Engage the gear cluster in Fourth (A) and Reverse (B). Push down on "A" and "B" to do this.

1. Bolts. Use a 13 mm socket and driver.
2. Cover. Tap gently with a soft-faced hammer.
3. Shim (selective).
4. Oil Shield.
5. Retainer, output gear cluster, using J-36031 or equivalent. J-36031 is a 12 mm hex bit socket, 1/2-in. drive, and a large breaker bar.
6. Retainer, input gear cluster, using J-36031 or equivalent. These retainers will not be re-used. Replace them with:

   P/N 14092025 output shaft retainer
   P/N 14092024 input shaft retainer

- Return transmission to neutral.

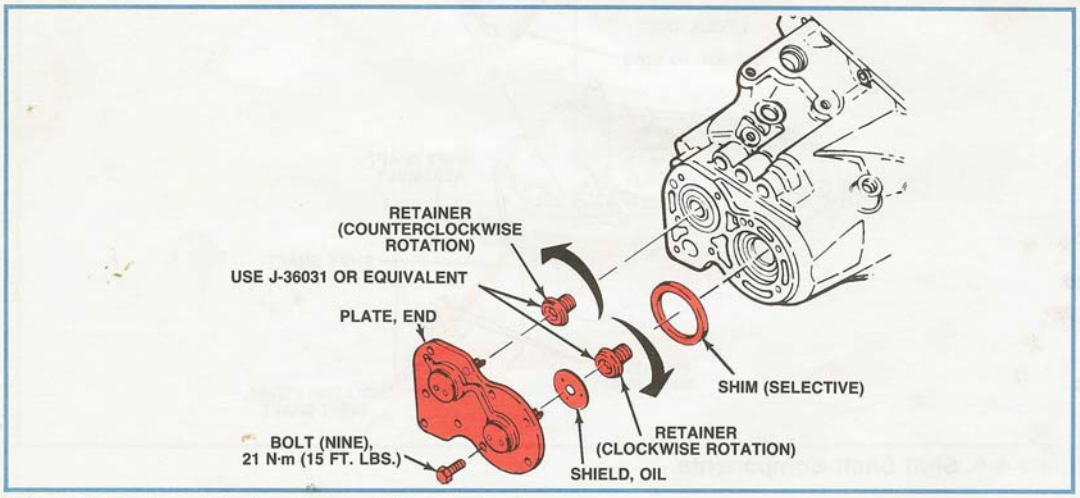



Figure 5-8, **Gear Cluster Support Components.**

## Gear Clusters

See Figure 5-9 ...

### Remove or Disconnect ...

Tools Required:

Hydraulic Press

J-36182-1 Gear Cluster and Transmission Case Assembly/Disassembly Pallet

J-36182-2 Disassembly Adapters (two)

J-36185 Gear Cluster Remover

1. Position J-36182-1 and -2 in hydraulic press.
2. Position transmission case/gear cluster assembly (A) on J-36182-1 and -2.
   - Align shift rail and shaft pilots to the fixture.
3. Position J-36185 on shaft support bearings and pilots.
   - Using a hydraulic press, separate the shaft and gear clusters from the transmission case.

After this operation, the input and output shaft bearings should be discarded. Replace them with:

P/N 14082115 output shaft bearing
P/N 14092066 input shaft bearing

Remove the gear clusters from the pallets, as an entire assembly.

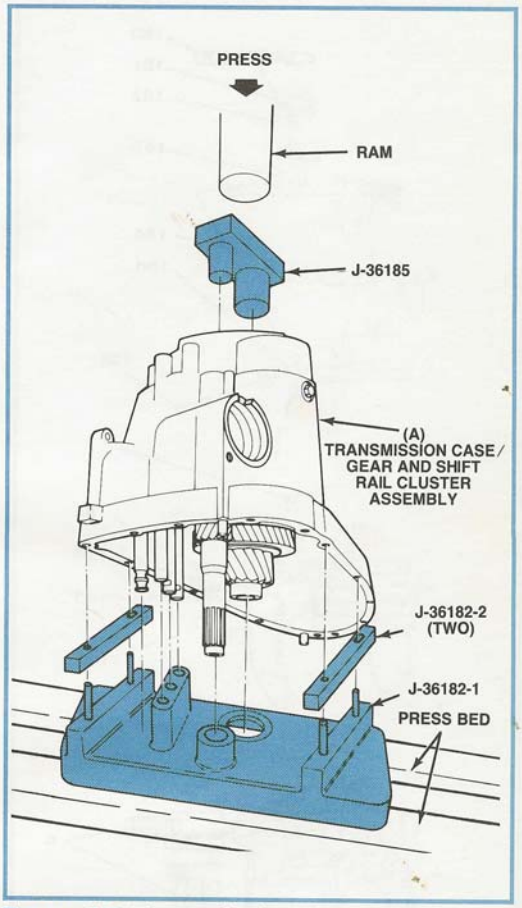
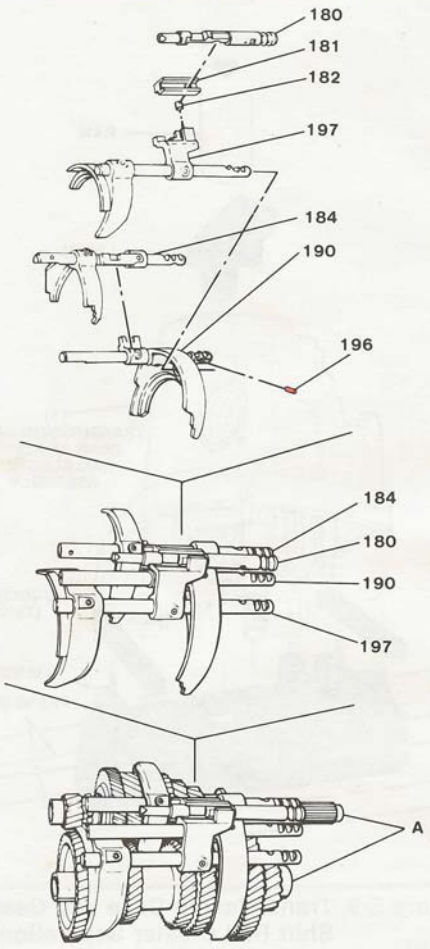



**Figure 5-9, Transmission Case and Gear/ Shift Rail Cluster Separation.**




A. GEAR CLUSTER AND SHIFT RAIL ASSEMBLY

180. REVERSE RAIL
181. SHIFT GATE
182. ROLLER
184. 3RD/4TH RAIL
190. 1ST/2ND RAIL
196. INTERLOCK PIN
197. 5TH RAIL

**Figure 5-10, Shift Rail Assemblies.**

## Gear Clusters and Shift Rails

See Figure 5-10 ...

### Remove or Disconnect ...

This should be done on a workbench after taking the gear clusters off the pallet.

- 1-2 shift rail assembly (190), lock pin (196).
- 3-4 rail assembly (184).
- 5th rail assembly (197).
- Reverse rail assembly (180).
  - shift gate (181), disengage roller (182)

Be careful not to lose both the lock pin and the gear disengage roller, as they are small parts. The lock pin P/N is 14092017. The gear disengage roller P/N is 14092090.

# Unit Subassembly Repair and Inspection

**— IMPORTANT —**

**The following components will require heating prior to installation during assembly procedures. A suggested heating oven is a toaster oven (used as a kitchen appliance).**

- **7-10 minutes, 120°C (250°F).**
  - **races (6 and 40)**
  - **gear assembly (3)**
  - **speedo gear (electronic) (72)**
- **5 minutes, hot tap water.**
  - **speedo gear (mechanical) (71)**
- **20 minutes MINIMUM, 120°C (250°F).**
  - **gear cluster (37)**

## Input Shaft

See Figure 5-11 ...

### Disassemble ...

Tools Required:

Hydraulic Press
J-36183 Input/Output Shaft Gears Press Tube
J-36184 Input/Output Shaft Press Tube Reducer

**— IMPORTANT —**

**Identify blocker ring (14) for third gear and blocker ring (7) for fourth gear. DO NOT MIX.**

1. Snap ring (2). Discard this snap ring and replace it with P/N 10051664, if stretched.
2. Gear (3) and (4), bearings (5), race (6), blocker ring (7 and 14), synchronizer assembly (8) and gear (15), using J-36183, J-36184 and hydraulic press.
3. Third gear bearing (16).

**Inspect ...**

- Clean with solvent, air dry.
- Input shaft components.
  - shaft (17), spline wear or cracks, replace if these conditions exist
  - gear teeth (3), (4), (15), for scuffed, nicked, burred, or broken teeth
  - bearings (5), (16), for roughness of rotation, burred or pitted condition, replace if these conditions exist
  - bearing races (6), (17, shaft), for scoring, wear or overheating
  - snap ring (2), for nicks, distortion or wear
  - synchronizer assembly (8) (REFER TO SYNCHRONIZER REPAIR)
- If scuffed, nicked, burred or scoring conditions cannot be removed with a soft stone or crocus cloth, replace the component.

Replacement parts include:

- Input shaft P/N 14092065* (14 teeth for 1st, 20 teeth for 2nd, 12 teeth for reverse)
- Third gear bearing P/N 10051603
- Third speed gear P/N 10051614 (24 teeth)
- Third or fourth gear blocking ring P/N 10051627
- 3-4 synchronizer assembly P/N 10051604**
- Fourth gear bearing race P/N 14082121
- Fourth gear bearing P/N 9441542
- Fourth speed gear P/N 10051621 (35 teeth)
- Fifth gear P/N 10051618 (43 teeth)

*P/N 14082051 has 14 teeth for 1st, 21 teeth for 2nd, 12 teeth for reverse.

**Springs (P/N 14082096) and balls (P/N 14082095) are available separately, as are keys (P/N 14082094).

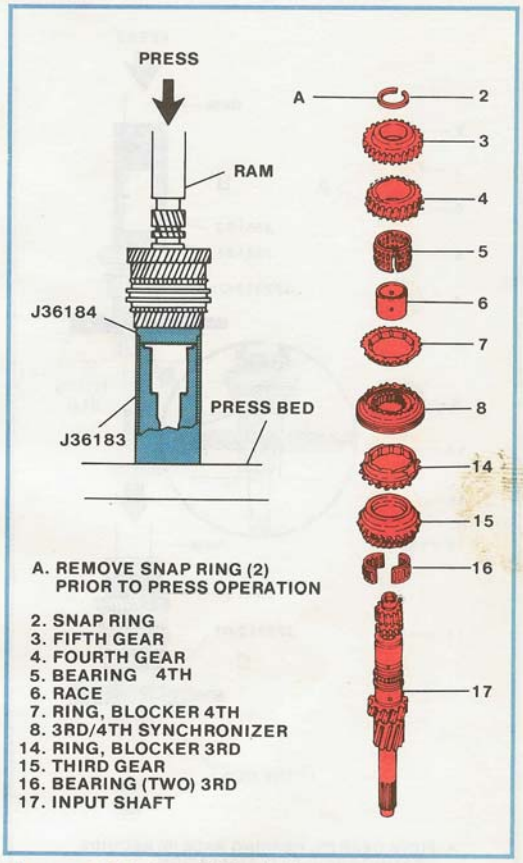
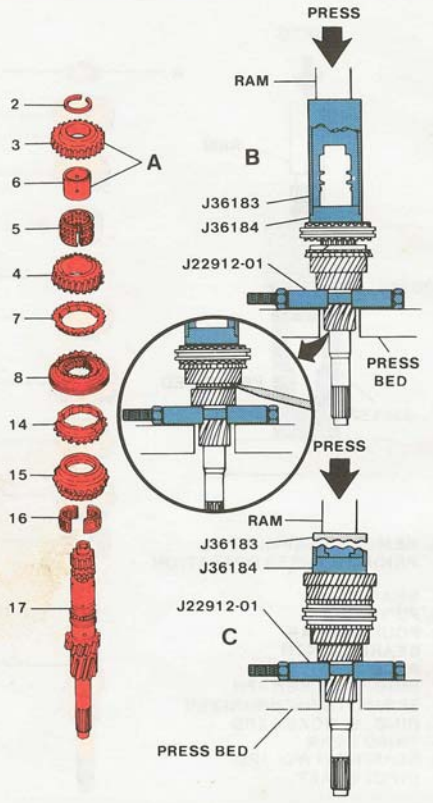



**Figure 5-11, Input Shaft Components Removal.**




A. FIFTH GEAR (3), BEARING RACE (6) REQUIRE HEATING PRIOR TO INSTALLATION
B. START PRESS OPERATION OF 3RD/4TH GEAR SYNCHRONIZER (8). DO NOT CONTACT BLOCKER RING (14)
LIFT GEARS (15) AND (14) WITH PROBE TO ENGAGE BLOCKER RING (14) INTO SYNCHRONIZER (8). CONTINUE PRESS OPERATION
C. PRESS FIFTH GEAR (3)

2. SNAP RING
3. 5TH GEAR
4. 4TH GEAR
5. BEARING, 4TH GEAR
6. RACE, BEARING 4TH GEAR
7. BLOCKER RING, 4TH GEAR
8. SYNCHRONIZER ASSEMBLY, 3RD/4TH GEAR
14. BLOCKER RING, 3RD GEAR
15. 3RD GEAR
16. BEARING, 3RD GEAR
17. SHAFT, INPUT

**Figure 5-12, Input Shaft Components Installation.**

### Assemble ...

See Figure 5-12 ...

Tools Required:

Oven

Hydraulic Press

J-22912-01 Input/Output Shaft Gears Remover/Installer

J-36183 Input/Output Shaft Press Gears Press Tube

J-36184 Input/Output Shaft Press Tube Reducer

- Lubricate all components as assembly progresses. Use lubricant P/N 1052931 or equivalent.
- Bearing race (6) and fifth gear (3) require heating in oven at 120°C (250°F) for 7-10 minutes.

### Install or Connect ...

See Figure 5-12 ...

1. Bearing (16).
2. Third gear (15) (cone up).
3. Blocker ring (14).

**— IMPORTANT —**

**When pressing the 3-4 synchronizer assembly (8):**

- **Start press operation, STOP before tangs engage.**
- **Lift and rotate gears (14 and 15) into synchronizer tangs.**
- **Continue to press until seated.**
- **Be sure all shavings are removed.**

4. 3-4 synchronizer (8), using J-22912-01, J-36183, J-36184 and hyrdraulic press. J-22828 presses fourth gear bearing race on very well.
   - Side marked 3RD gear and small O.D. groove of sleeve toward the gear (15).
5. Bearing race and bearing.
   - Use gloves to handle hot race. Check temperature with tempilstick or thermometer.
6. Blocker ring (7).
7. Fourth gear (4) (cone down).
8. Fifth gear (3) (flat side down) using J-36183, J-36184 and hydraulic press.
9. Snap ring (2).

## Output Shaft

See Figure 5-13 ...

### Disassemble ...

Tools Required:

15-Ton Press (MINIMUM)

J-22912-01 Input/Output Shaft Gears Remover/Installer

J-36183 Input/Output Shaft Gears Press Tube

**— IMPORTANT —**

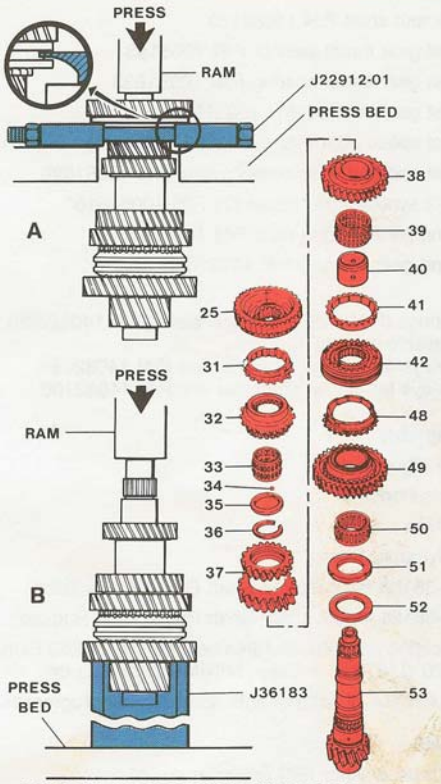
**Identify blocker ring (31) for fifth gear, blocker ring (41) for second gear, and blocker ring (48) for first gear. DO NOT MIX.**

### Remove or Disconnect ...

1. Reverse gear-fifth gear synchronizer assembly (25), using J-22912-01 and hydraulic press.
2. Blocker ring (3).
3. Fifth speed gear (32).
4. Fifth gear bearing (33).
5. Thrust washer (35).
6. Ball (34).
7. Snap ring (36). Discard this snap ring and replace it with P/N 14080548, if stretched.
8. First gear (49), bearing (50), caged thrust bearing (51) and thrust washer (52), using J-36183 and 15-ton press (MINIMUM).
   - Second gear (38), bearing (39), race (40), 1-2 synchronizer (42), blocker rings (41 and 48) and 3-4 gear cluster (37) will press off with first gear.

### Inspect ...

- Clean with solvent, air dry.
- Output shaft components.
  - shaft (53) for spline wear or cracks, replace if these conditions exist
  - gear teeth (53), (49), (38), (37), (32), (25) for scuffed, nicked, burred, or broken teeth
  - bearing races (53), (40), for scoring, wear or overheating
  - bearings, for roughness of rotation, burred or pitted condition, replace if these conditions exist
  - synchronizer (42) and (25) (REFER TO SYNCHRONIZER REPAIR)
- If scuffed, nicked, burred or scoring conditions cannot be removed with a soft stone or crocus cloth, replace the component.




A. INSTALL J22912-01 IN SLEEVE GROOVE OR ON GEAR FACE ONLY
B. SNAP RING (36) MUST BE REMOVED PRIOR TO PRESS OPERATION. FIRST GEAR (49) ON J36183

25. REVERSE GEAR/5TH GEAR SYNCHRONIZER
31. BLOCKER RING, 5TH GEAR
32. GEAR, 5TH SPEED
33. BEARING, 5TH GEAR
34. BALL, THRUST WASHER POSITIONER
35. THRUST WASHER
36. SNAP RING
37. GEAR, 3RD/4TH CLUSTER
38. GEAR, 2ND SPEED
39. BEARING, 2ND GEAR
40. RACE, 2ND GEAR BEARING
41. BLOCKER RING, 2ND GEAR
42. SYNCHRONIZER ASSEMBLY, 1ST/2ND GEAR
48. BLOCKER RING, 1ST GEAR
49. GEAR, 1ST SPEED
50. BEARING, 1ST GEAR
51. BEARING, THRUST
52. WASHER, THRUST
53. SHAFT, OUTPUT

**Figure 5-13, Output Shaft Components Removal.**

Replacement parts include:

- Output shaft P/N 14082129
- 1st gear thrust washer P/N 10051634
- 1st gear thrust bearing P/N 10051633
- 1st gear bearing P/N 10051601
- 1st speed gear P/N 14092095 (49 teeth)
- 1st and 2nd gear blocking ring P/N 10051626
- 1-2 synchronizer assembly P/N 10051610*
- 2nd gear bearing race P/N 14080545
- 2nd gear bearing P/N 10051602
- 2nd speed gear P/N 10051616 (41 teeth) or P/N 10051615 (46 teeth)
- 3-4 cluster gear P/N 10051619 (33 teeth each)
- 5th gear thrust washer P/N 14080546
- thrust washer retaining ball P/N 14080547
- 5th gear bearing P/N 9441543
- 5th speed gear P/N 10051620 (31 teeth)
- 5th gear blocking ring P/N 10051627
- Reverse gear/5th synchronizer assembly P/N 14082091*

*Springs (P/N 14082096) and balls (P/N 14082095) are available separately.
Keys for 1-2 synchronizer are P/N 14082094.
Keys for 5th synchronizer are P/N 14082106.

### Assemble ...

See Figure 5-14 ...

Tools Required:

Oven

Hyrdaulic Press

J-36183 Input/Output Shaft Gears Press Tube

J-36184 Input/Output Shaft Press Tube Reducer

- Bearing race (40) requires heating 120°C (250°F) in oven, minimum 7-10 minutes. 3-4 gear cluster (37) requires heating 120°C (250°F) in oven, MINIMUM 20 minutes.
- Lubricate all components as assembly progresses. Use lubricant P/N 1052931 or equivalent.

### Install or Connect ...

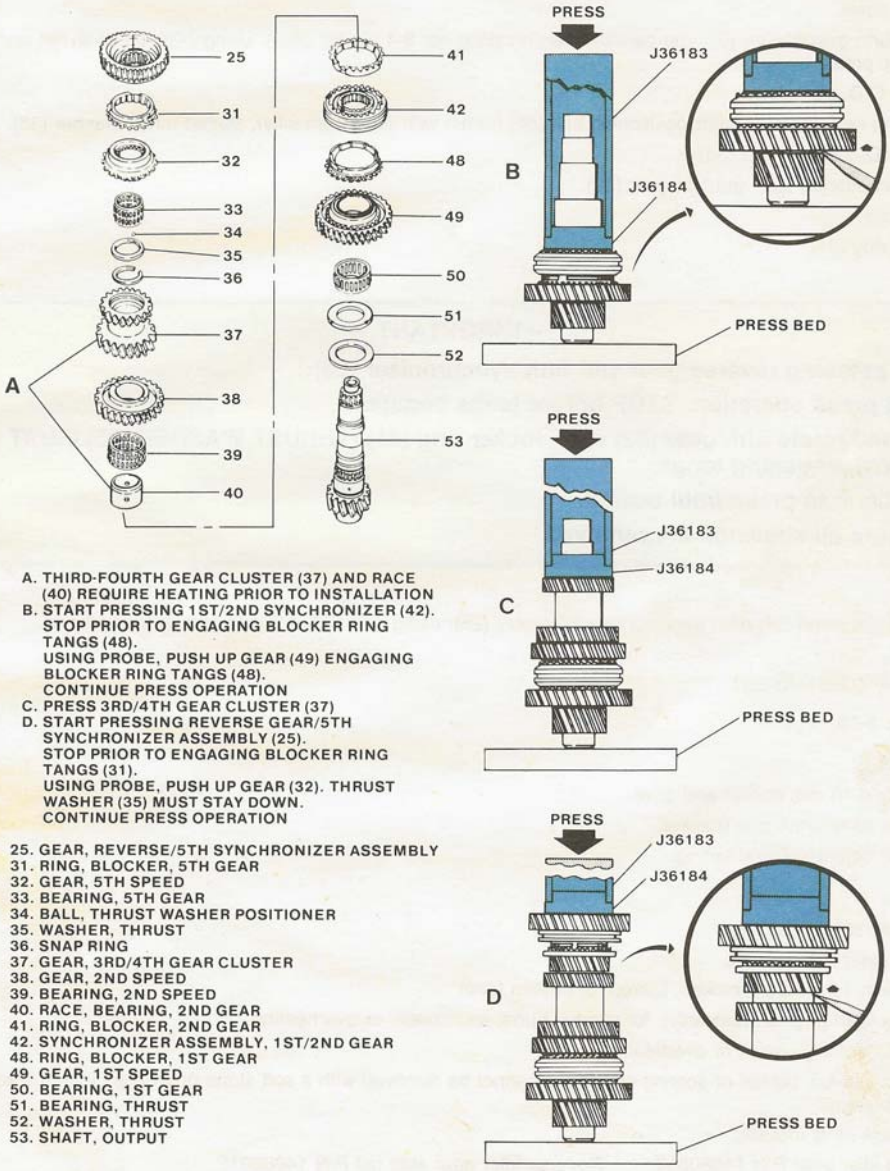
1. Thrust washer (52) (chamfer down).
   Caged thrust bearing (51) (needles down).
   First gear bearing (50).
   First gear (49) (cone up).
2. Blocker ring (48).

**— IMPORTANT —**

**When pressing the 1-2 synchronizer assembly (42):**

- **Start press operation, STOP before tangs engage.**
- **Lift and rotate gears (49) and (48), to engage blocker ring tangs.**
- **Continue to press until seated.**
- **Be sure all shavings are removed.**

3. 1-2 synchronizer (42), using J-36183, J-36184 and hydraulic press. Use J-22828 to do this.
   - Side marked 1ST and small O.D. groove on sleeve toward first gear (49).




A. THIRD-FOURTH GEAR CLUSTER (37) AND RACE (40) REQUIRE HEATING PRIOR TO INSTALLATION
B. START PRESSING 1ST/2ND SYNCHRONIZER (42). STOP PRIOR TO ENGAGING BLOCKER RING TANGS (48). USING PROBE, PUSH UP GEAR (49) ENGAGING BLOCKER RING TANGS (48). CONTINUE PRESS OPERATION
C. PRESS 3RD/4TH GEAR CLUSTER (37)
D. START PRESSING REVERSE GEAR/5TH SYNCHRONIZER ASSEMBLY (25). STOP PRIOR TO ENGAGING BLOCKER RING TANGS (31). USING PROBE, PUSH UP GEAR (32). THRUST WASHER (35) MUST STAY DOWN. CONTINUE PRESS OPERATION

25. GEAR, REVERSE/5TH SYNCHRONIZER ASSEMBLY
31. RING, BLOCKER, 5TH GEAR
32. GEAR, 5TH SPEED
33. BEARING, 5TH GEAR
34. BALL, THRUST WASHER POSITIONER
35. WASHER, THRUST
36. SNAP RING
37. GEAR, 3RD/4TH GEAR CLUSTER
38. GEAR, 2ND SPEED
39. BEARING, 2ND SPEED
40. RACE, BEARING, 2ND GEAR
41. RING, BLOCKER, 2ND GEAR
42. SYNCHRONIZER ASSEMBLY, 1ST/2ND GEAR
48. RING, BLOCKER, 1ST GEAR
49. GEAR, 1ST SPEED
50. BEARING, 1ST GEAR
51. BEARING, THRUST
52. WASHER, THRUST
53. SHAFT, OUTPUT

**Figure 5-14, Output Shaft Components Installation.**

4. Second gear bearing race (40) (Be careful handling hot bearing race), bearing (39), second gear (38).
   - Cone down.
5. Third-fourth gear cluster (37) (be careful when handling hot 3-4 cluster gear), using J-36183, J-36184 and hydraulic press.
   - Large O.D. gear down.
6. Snap ring (36), thrust washer positioning ball (34) (retain with petroleum jelly), slotted thrust washer (35).
   - Align I.D. slot with ball (34).
7. Fifth gear bearing (33) and fifth gear (32).
   - Cone up.
8. Blocker ring (31).

**— IMPORTANT —**

**When pressing reverse gear and fifth synchronizer (25):**

- **Start press operation, STOP before tangs engage.**
- **Lift and rotate fifth gear (32) and blocker ring (31) (THRUST WASHER (35) MUST STAY DOWN), engaging tangs.**
- **Continue to press until seated.**
- **Be sure all shavings are removed.**

9. Reverse gear and fifth gear synchronizer assembly (25), using J-36183, J-36184 and hydraulic press.

## Reverse Idler Gear

See Figure 5-15 ...

### Disassemble ...

1. Bolt. Use a 13 mm socket and driver.
2. Shift rail, gear, shaft and bracket.
3. Shift rail, detent ball and spring.

### Inspect ...

- Clean with solvent, air dry.
- Reverse gear components.
  - gear teeth, for scuffed, nicked, burred, or broken teeth
  - bushing (part of gear assembly), for scores, burrs, roundness, or overheating
  - shaft, for scoring, wear, or overheating
- If scuffed, nicked, burred or scoring conditions cannot be removed with a soft stone or crocus cloth, replace the component.

Replacement parts include:

| | |
|---|---|
| Reverse idler gear P/N 14080558 | Reverse idler gear shift rail P/N 14082012 |
| Reverse idler shaft P/N 14080538 | Reverse idler gear bracket P/N 14082180* |

*Spring (P/N 14082036), ball (P/N 14082035), and sleeve (P/N 14092022) are available separately.

### Assemble ...

- Lubricate all components as assembly progresses. Use lubricant P/N 1052931 or equivalent.

### Install or Connect ...

1. Assemble spring, ball in bracket.
2. Shaft in bracket assembly.
3. Gear on shaft.
   - Slot on gear toward threaded hole in shaft.
4. Reverse idler gear assembly.
5. Bolt, 21 N·m (16 ft. lbs.). Use a 13 mm socket and driver.

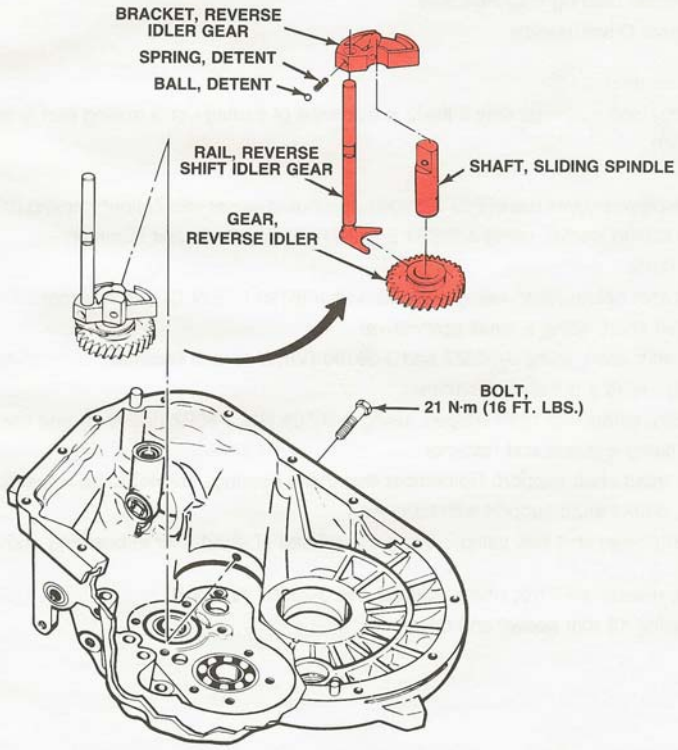



**Figure 5-15, Reverse Idler Gear Components.**

## Transmission Case

See Figure 5-16 ...

### Disassemble ...

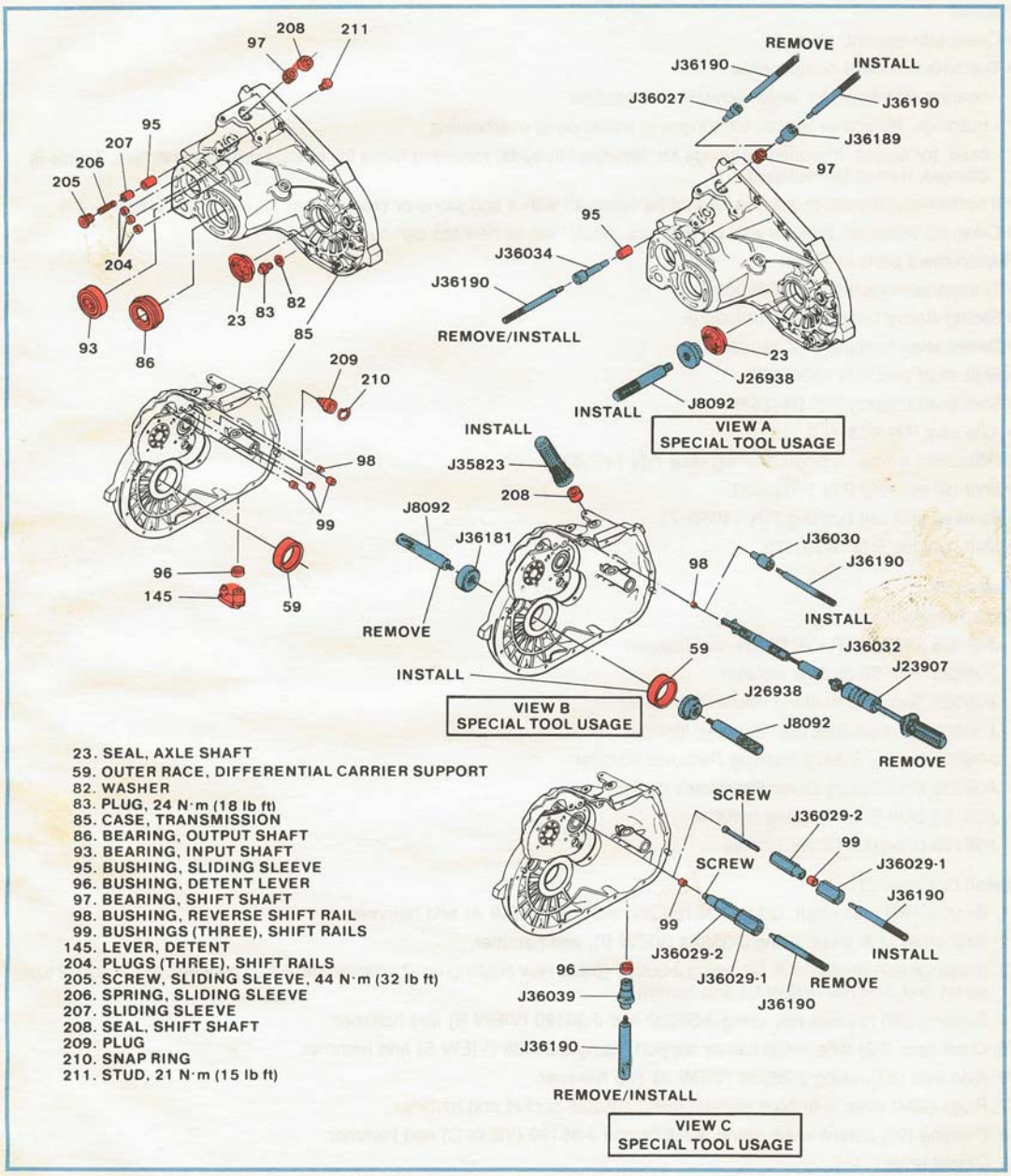
Tools Required:

J-8092 Universal Driver Handle
J-23907 Slide Hammer and Adapter Set
J-36027 Shift Shaft Bearing Remover
J-36029 Shift Rail Bushing Remover/Installer
J-36032 Clutch Shaft Inner Bushing/Reverse Shift Rail Remover
J-36034 Sliding Sleeve Bushing Remover/Installer
J-36039 Shift Detent Lever Bushing Remover/Installer
J-36181 Differential Bearing Cup Remover
J-36190 Universal Driver Handle

### Remove or Disconnect ...

- Remove bearings and bushings only if there is evidence of damage or a mating part is being replaced.

1. Snap ring (210).
2. Plug (209).
3. Screw (205) (screw requires use of P/N 1052080 pipe thread sealer with Teflon®), spring (206) and sliding sleeve (207).
4. Bushing (95) sliding sleeve, using J-36034 and J-36190 (VIEW A) and hammer.
5. Detent lever (145).
6. Bushing (96) shift detent lever, using J-36039 and J-36190 (VIEW C) and hammer.
7. Seal (208) shift shaft, using a small screwdriver.
8. Bearing (97) shift shaft, using J-36027 and J-36190 (VIEW A) and hammer.
9. Axle seal (23), using a punch and hammer.
10. Outer race (59), differential case support, using J-36181 and J-8092 (VIEW B) and hammer.
11. Plugs (204), using a punch and hammer.
12. Bearing (93), input shaft support. Remember that these bearings are not to be re-used.
13. Bearing (86), output shaft support with hammer.
14. Bushings (99) (three) shift rail, using J-36029 (small end of -2 adapter in bushing) and J-36190 (VIEW C) and hammer.
15. Bushing (98), reverse shift rail, using J-36032 and J-23907 (VIEW B).
16. Stud (211), using 13 mm socket and driver.




23. SEAL, AXLE SHAFT
59. OUTER RACE, DIFFERENTIAL CARRIER SUPPORT
82. WASHER
83. PLUG, 24 N·m (18 lb ft)
85. CASE, TRANSMISSION
86. BEARING, OUTPUT SHAFT
93. BEARING, INPUT SHAFT
95. BUSHING, SLIDING SLEEVE
96. BUSHING, DETENT LEVER
97. BEARING, SHIFT SHAFT
98. BUSHING, REVERSE SHIFT RAIL
99. BUSHINGS (THREE), SHIFT RAILS
145. LEVER, DETENT
204. PLUGS (THREE), SHIFT RAILS
205. SCREW, SLIDING SLEEVE, 44 N·m (32 lb ft)
206. SPRING, SLIDING SLEEVE
207. SLIDING SLEEVE
208. SEAL, SHIFT SHAFT
209. PLUG
210. SNAP RING
211. STUD, 21 N·m (15 lb ft)

Figure 5-16, **Transmission Case Components.**

### Inspect ...

- Clean with solvent, air dry.
- Transmission case components.
  - bearing race bore, for wear, scratches or grooves
  - bushings, for scores, burrs, roundness or evidence of overheating
  - case, for cracks, threaded openings for damaged threads, mounting faces for nicks, burrs or scratches; if case is cracked, it must be replaced
- If scratches, grooves or scoring cannot be removed with a soft stone or crocus cloth, replace the component.
- Clean up damaged threads with correct size "used" tap (a new tap can cut oversize).

Replacement parts include:

- Transmission case P/N 14092064.
- Sliding sleeve bushing P/N 14092005.
- Detent lever bushing P/N 14080570.
- Shift shaft seal P/N 14080587.
- Shift shaft bearing P/N 9441538.
- Axle seal P/N 8631156.
- Differential carrier support bearing race P/N 7455633.
- Shift rail bushing P/N 14080583.
- Reverse shift rail bushing P/N 14080571.
- Shift rail plug P/N 14080573.

### Assemble ...

Tools Required:

J-26938 Seal and Race, Differential Installer
J-35823 Shift Shaft Seal Installer
J-36029 Shift Rail Bushing Remover/Installer
J-36030 Reverse Shift Rail Bushing Installer
J-36034 Sliding Sleeve Bushing Remover/Installer
J-36039 Shift Detent Lever Remover/Installer
J-36189 Shift Shaft Bearing Installer
J-36190 Universal Driver Handle

### Install or Connect ...

1. Bearing (97) shift shaft, using J-36189 and J-36190 (VIEW A) and hammer.
2. Seal (208) shift shaft, using J-35823 (VIEW B), and hammer.
3. Bushings (99) (three) shift rail, using J-36029 (place new bushing on -2 adapter and retain between the -1 and -2 tool parts) and J-36190 (VIEW C) and hammer.
4. Bushing (98) reverse rail, using J-36030 and J-36190 (VIEW B) and hammer.
5. Outer race (59) differential carrier support, using J-26938 (VIEW B) and hammer.
6. Axle seal (23), using J-26938 (VIEW A) and hammer.
7. Plugs (204) even with bore surface using suitable socket and hammer.
8. Bushing (96) detent lever, using J-36039 and J-36190 (VIEW C) and hammer.
9. Detent lever (145).
10. Bushing (95) sliding sleeve, using J-36034 and J-36190 (VIEW A) and hammer.

11. Sleeve (207), spring (206) and screw (205), 44 N·m (32 ft. lbs.) using sealer.
12. Plug (209) and snap ring (210), flat side up.
13. Stud (211), chamfer end out, 21 N·m (15 ft. lbs.).

## Clutch and Differential Housing

See Figure 5-17 ...

### Disassemble ...

Tools Required:

Hydraulic Press
J-8092 Universal Driver Handle
J-23907 Slide Hammer and Adapter Set
J-35824 Input Bearing Assembly Remover/Installer
J-36029 Shift Rail Bushing Installer/Remover
J-36032 Clutch Shaft Inner Bushing/Reverse Shift Rail Remover
J-36037 Clutch Shaft Upper Bushing Remover/Installer
J-36038 Output Shaft Race Bearing Remover
J-36181 Differential Bearing Cup Remover

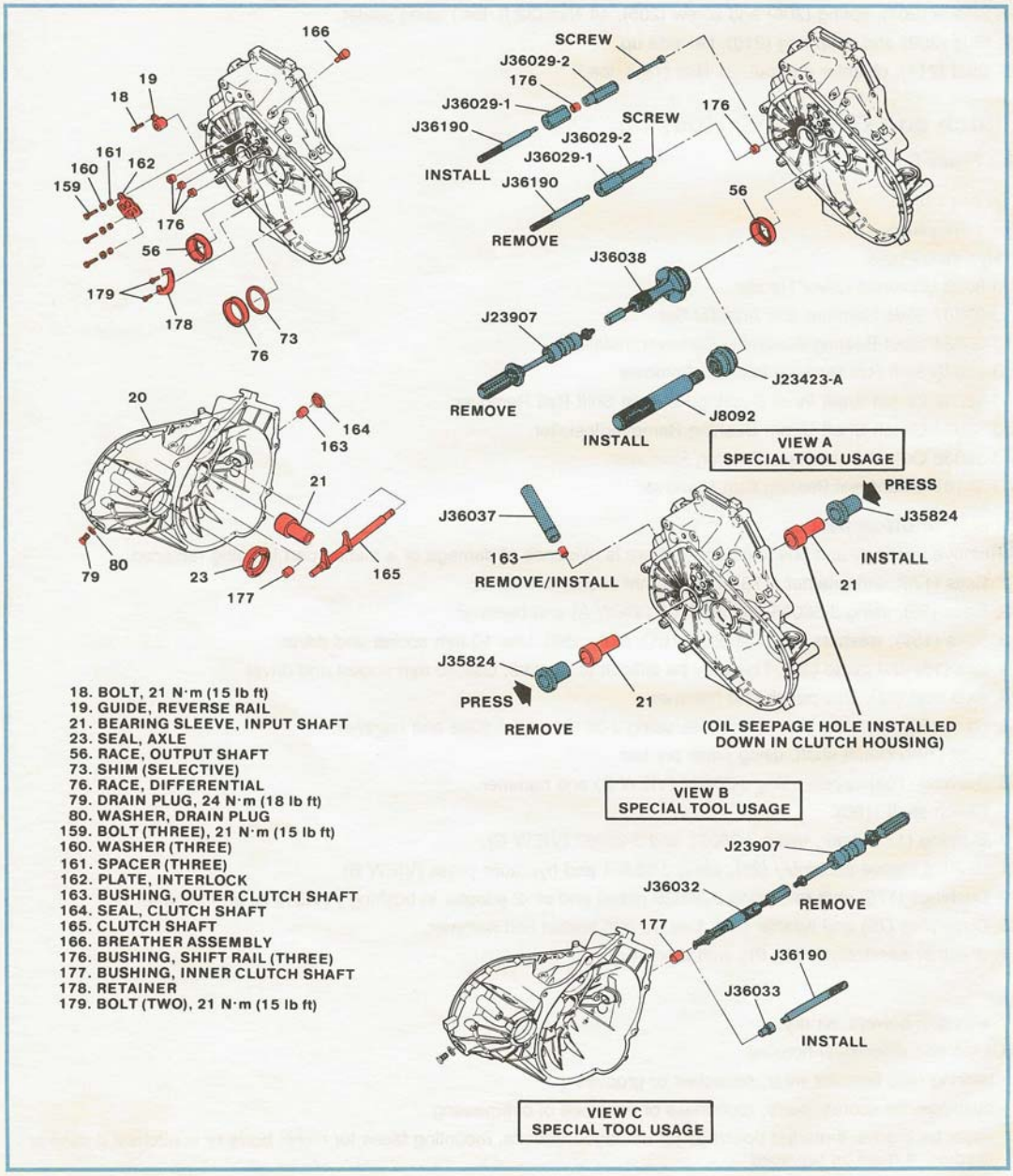
### Remove or Disconnect ...

- Remove bearings and bushings only if there is evidence of damage or a mating part is being replaced.

1. Bolts (179) and retainer (178). Use 10 mm socket and driver.
2. Race (56), using J-36038 and J-23907 (VIEW A) and hammer.
3. Bolts (159), washers (160), spacer (161), plate 162). Use 10 mm socket and driver.
4. Bolt (18) and guide (19). This may be difficult to remove. Use 10 mm socket and driver.
5. Axle seal (23). Use punch and hammer.
6. Race (76) and shim (73) differential, using J-36181 and J-8092 and hammer.
7. Seal (164) clutch shaft, using small pry bar.
8. Bushing (163) upper, using J-36037 (VIEW B) and hammer.
9. Clutch shaft (165).
10. Bushing (177) inner, using J-36032 and J-23907 (VIEW C).
11. Bearing sleeve assembly (21), using J-35824 and hydraulic press (VIEW B).
12. Bushings (176) shift rail, using J-36029 (small end of -2 adapter in bushing ) (VIEW A) and hammer.
13. Drain plug (79) and washer (80). Use 15 mm socket and hammer.
14. Breather assembly (166). Pry with a screwdriver.

### Inspect ...

- Clean with solvent, air dry.
- Clutch and differential housing.
  - bearing race bore for wear, scratches or grooves
  - bushings, for scores, burrs, roundness or evidence of overheating
  - case, for cracks, threaded openings for damaged threads, mounting faces for nicks, burrs or scratches; if case is cracked, it must be replaced
- If scratches, grooves or scoring cannot be removed with a soft stone or crocus cloth, replace the component.
- Clean up damaged threads with the correct size "used" tap (a new tap can cut oversize).




18. BOLT, 21 N·m (15 lb ft)
19. GUIDE, REVERSE RAIL
21. BEARING SLEEVE, INPUT SHAFT
23. SEAL, AXLE
56. RACE, OUTPUT SHAFT
73. SHIM (SELECTIVE)
76. RACE, DIFFERENTIAL
79. DRAIN PLUG, 24 N·m (18 lb ft)
80. WASHER, DRAIN PLUG
159. BOLT (THREE), 21 N·m (15 lb ft)
160. WASHER (THREE)
161. SPACER (THREE)
162. PLATE, INTERLOCK
163. BUSHING, OUTER CLUTCH SHAFT
164. SEAL, CLUTCH SHAFT
165. CLUTCH SHAFT
166. BREATHER ASSEMBLY
176. BUSHING, SHIFT RAIL (THREE)
177. BUSHING, INNER CLUTCH SHAFT
178. RETAINER
179. BOLT (TWO), 21 N·m (15 lb ft)

**Figure 5-17, Clutch and Differential Housing Components.**

Replacement parts include:

- Reverse rail guide P/N 14080589.
- Axle seal P/N 8631156.
- Differential carrier support bearing race P/N 7455633.
- Clutch shaft seal P/N 14092820.
- Clutch shaft upper bushing P/N 14092055.
- Clutch shaft lower bushing P/N 14092054.
- Input shaft bearing sleeve P/N 14082181.
- Shift rail bushing P/N 14080583.
- Clutch and differential housing P/N 14082163 for MG1, P/N 14080581 for MG2.

### Assemble ...

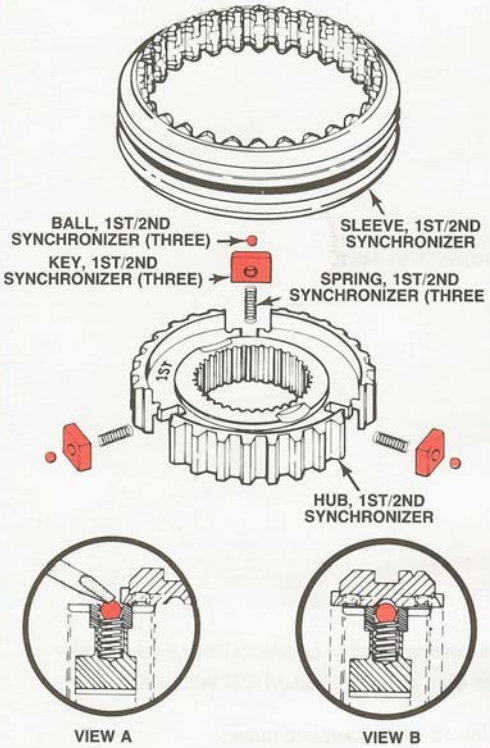
Tools Required:

Hydraulic Press
J-8092 Universal Drive Handle
J-23423-A Differential/Output Shaft Bearing Cup Installer
J-35824 Input Bearing Assembly Remover/Installer
J-36029 Shift Rail Bushing Installer
J-36033 Clutch Shaft Inner Bushing Installer
J-36037 Clutch Shaft Upper Bushing Remover/Installer
J-36190 Universal Driver Handle

### Install or Connect ...

- Bearings sleeve assembly (21), Bolts (159) and (179) require a small amount of Loctite 242® or equivalent.
- Do not install differential bearing race (76) and axle seal (23) or shim (73). INSTALLATION WILL BE AFTER DIFFERENTIAL BEARING SELECTIVE SHIMMING.

1. Drain plug (79) and NEW washer (80), 24 N·m (18 ft. lbs.). Use 15 mm socket and driver.
2. Bushings (176) shift rail, using J-36029 (place new bushings on -2 adapter and retain between the -1 and -2 tool parts) and J-36190 (VIEW A) and hammer.
   - BUSHINGS (176) MUST NOT PROTRUDE INTO CASE SIDE OF CLUTCH HOUSING.
3. Bearing sleeve assembly (21).
   - OIL SEEPAGE HOLE INSTALLED **DOWN** IN CLUTCH HOUSING, using J-35824 and hydraulic press (VIEW B).
4. Bushing (177) inner, using J-36033 and J-36190 (VIEW C) and hammer.
5. Clutch shaft (165).
6. Bushing (163) upper, using J-36037 (VIEW B) and hammer.
   - Outer end of bushing flush to bottom of seal bore.
7. Seal (164) clutch shaft, using suitable socket and hammer.
8. Guide (19), using hammer.
   - Short side in bore and bolt (18), 21 N·m (15 ft. lbs.).
9. Race (56), using J-23423-A and J-8092 (VIEW A) and hammer.
   - ALIGN RACE CUTOUTS WITH SLOTS IN CASE.
10. Retainer (178) and bolts (179), 21 N·m (15 ft. lbs.). Use 10 mm socket and driver; remember Loctite 242®.
11. Plate (162) innerlock, spacers (161), washers (160) and bolts (159), 21 N·m (15 ft. lbs.). Use 10 mm socket and driver; remember Loctite 242®.
12. Breather assembly (166) using hammer.




**1ST/2ND ASSEMBLY PROCEDURES**

**Install**

1. Sleeve, small O.D. groove up, onto hub, side marked 1ST up.
2. Spring into key.
3. Spring and key assemblies bevel cut on keys toward sleeve.
4. Position assembly as in View A.
5. Balls. Push the ball and key into the sleeve, using a screwdriver.
6. Center the hub, keys and balls. View B. Balls will "click" into position.

**Figure 5-18, 1st/2nd Gear Synchronizer Components.**

## Synchronizers

See Figures 5-18, 5-19 and 5-20 ...

### Disassemble ...

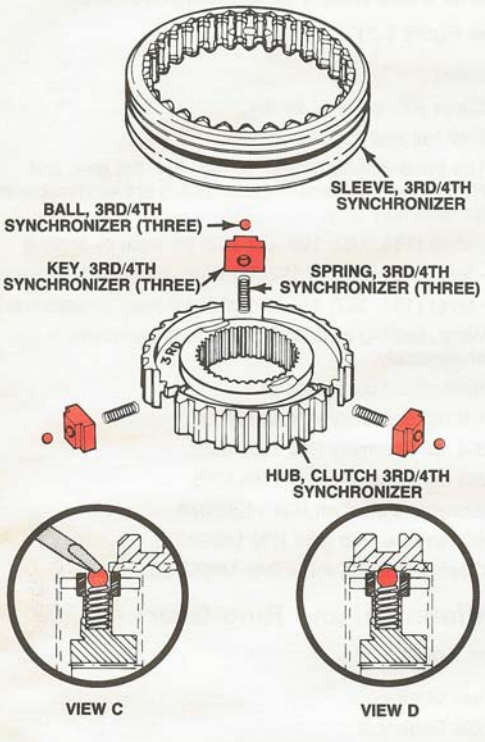
- Place 1-2, 3-4, and 5th speed synchronizers in separate shop towels, wrap assemblies and press against inner hub. Mark sleeve and hub for installation.

### Inspect ...

- Clean with solvent, air dry.
- Synchronizer components.
  - teeth for wear, scuffed, nicked, burred or broken teeth
  - keys, for wear or distortion; replace if these conditions are present
  - balls and springs, for distortion, cracks or wear; replace if these conditions are present
- If scuffed, nicked or burred conditions cannot be corrected with a soft stone or crocus cloth, replace the component.

### Assemble ...

- 1st/2nd gear synchronizer assembly, Figure 5-18.
- 3rd/4th gear synchronizer assembly, Figure 5-19.
- 5th gear synchronizer assembly, Figure 5-20.

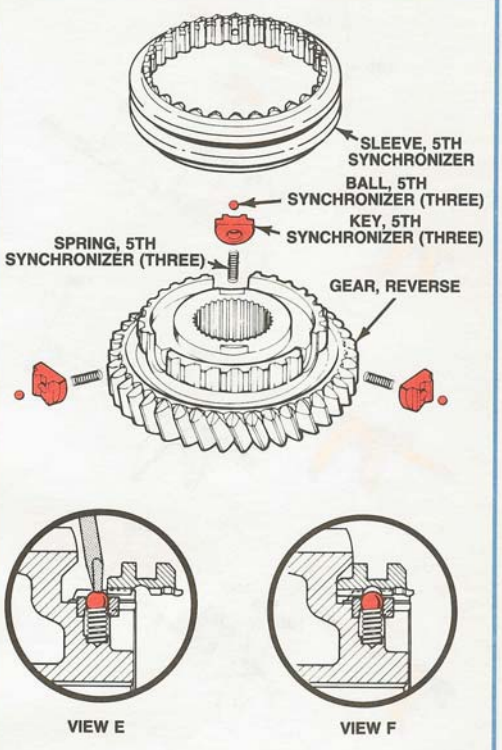



**3RD/4TH ASSEMBLY PROCEDURES**

**Install**

1. Sleeve, small O.D. groove up, onto hub, side marked 3RD up. Align the ball and spring pockets.
2. Spring into key.
3. Spring and key assemblies, stepped side of keys toward sleeve.
4. Position assemblys as in View C.
5. Balls. Push the ball and key into the sleeve, using a small screwdriver.
6. Center the hub, keys and balls. View D. Balls will "click" into position.

**Figure 5-19, 3rd/4th Gear Synchronizer Components.**

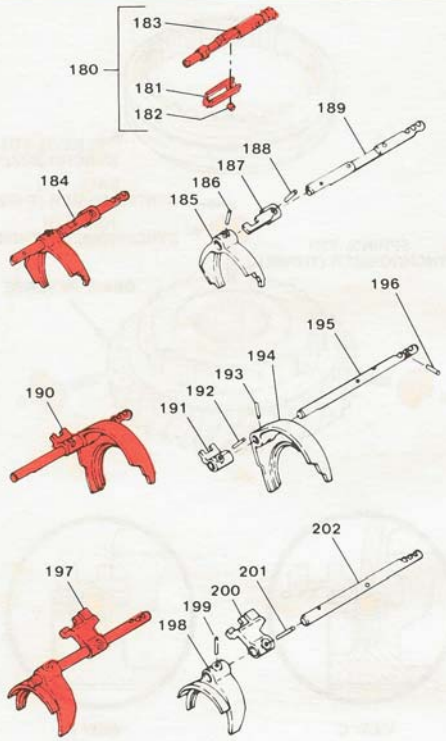



**5TH ASSEMBLY PROCEDURES**

**Install**

1. Spring into key.
2. Spring and key assemblies, teeth on keys out into slots on gear.
3. Sleeve, teeth up. Align the ball and spring pockets.
4. Position assembly as in View E.
5. Balls. Push the ball and key into the sleeve, using a small screwdriver.
6. Center the sleeve, keys and balls. View F. Balls will "click" into position.

**Figure 5-20, 5th Gear Synchronizer Components.**




180. RAIL, REVERSE SHIFT ASSEMBLY
181. SHIFT GATE, 5TH/REVERSE
182. ROLLER, GEAR DISENGAGE
183. SHAFT, REVERSE SHIFT
184. RAIL, 3RD/4TH SHIFT ASSEMBLY
185. FORK, 3RD/4TH SHIFT SHIFT
186. PIN, FORK RETAINER
187. LEVER, 3RD/4TH SELECT
188. PIN, LEVER RETAINER
189. SHAFT, 3RD/4TH SHIFT
190. RAIL, 1ST/2ND SHIFT ASSEMBLY
191. LEVER, 1ST/2ND SELECT
192. PIN, LEVER RETAINER
193. PIN, FORK RETAINER
194. FORK, 1ST/2ND SHIFT
195. SHAFT, 1ST/2ND SHIFT
196. PIN, LOCK
197. RAIL, 5TH SHIFT ASSEMBLY
198. FORK, 5TH SHIFT
199. PIN, FORK RETAINER
200. LEVER, 5TH SHIFT
201. PIN, LEVER RETAINER
202. SHAFT, 5TH SHIFT

**Figure 5-21, Shift Rail and Fork Assemblies.**

## Shift Rail and Fork Assemblies

See Figure 5-21 ...

### Inspect ...

- Clean with solvent, air dry.
- Shift rail and fork assemblies.
- The parts that compose the 1-2, 3-4, 5th gear and Reverse shift rail and fork assemblies are serviceable as an assembly only.
  - shaft (183, 189, 195 and 202) for wear or scoring
  - fork (185, 194 and 198) for wear, scoring or distortion
  - lever (181, 187, 191 and 200) for wear or distortion
- Wear, scoring or distortion requires replacement of assembly.

Replacement parts include:

- 1-2 rail assembly P/N 10051631.
- 3-4 rail assembly P/N 10051632.
- 5th rail assembly P/N 14092083.
- Reverse shift shaft P/N 14092076.
- 5th/reverse shift gate P/N 14092078.
- Gear disengage roller P/N 14092090.

## Differential and Ring Gear

See Figure 5-22 ...

### Disassemble ...

Tools Required:

J-2241-11 or J-23598 Side Bearing Puller Adapter

J-22888 Bearing Remover

J-22888-35 Bearing Remover Leg (two)

### Remove or Disconnect ...

1. Bolts (77). Use 15 mm socket and driver. Discard.
2. Gear (70).
3. Bearings (75 and 60), using J-22888, J-22888-35 (two), and J-2241-11 or J-23598.
4. Speedo gear (71 or 72). Use prybar. Do not re-use – removal will destroy gear (71).
5. Bolt (68) and washer (69). Use 5 mm allen wrench.
6. Pin (63).
7. Gears (67) and washer (64), gears (66) and washers (65). Identify parts for same installation.

### Inspect ...

- Clean with solvent, air dry.
- Differential components.

- gears (70, 71 or 72, 67 and 66), for scuffed, nicked, burred or broken teeth
- carrier (61), for distortion, bores out of round or scoring; replace if these conditions are present
- bearings (60 and 75) for roughness of rotation, burred or pitted condition; replace if these conditions exist
- thrust washers (64 and 65) for wear, scuffed, nicked or burred condition

- If scuffed, nicked, burred or scoring conditions cannot be removed with a soft stone or crocus cloth, replace the component.

Replacement parts include:

- Differential assembly carrier P/N 14080522.
- Differential pinion gear P/N 8658490.
- Differential pinion gear washer P/N 463061.
- Differential cross pin P/N 463062.
- Differential side gear P/N 14076988.
- Differential side gear washer P/N 14040531.
- Cross pin retaining screw P/N 463063.
- Differential ring gear P/N 14082130.
- Differential ring gear bolt P/N 14080521.
- Differential bearing P/N 7455634.
- Speedometer gear P/N 14047637.
- Speedometer sensor rotor P/N 23046436 (28-tooth) or P/N 23046468 (34-tooth).

### Assemble ...

Tools Required:

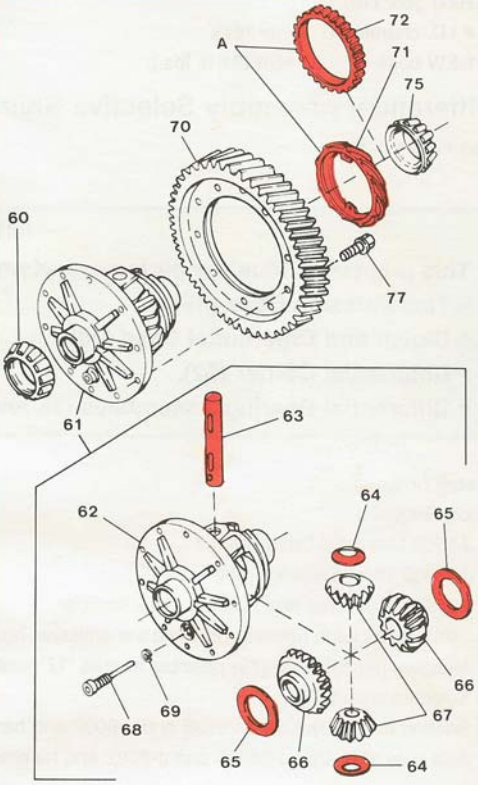
Hydraulic Press

J-22919 Differential Inner Bearing Installer

- Heat mechanical configuration nylon speedo drive gear (71) in hot tap water for five minutes prior to installation.
- Heat electronic configuration steel speedo drive gear (72) in oven at 120°C (250°F) for 7-10 minutes prior to installation.
- Do not re-use bolts (77), ONE-TIME USE ONLY.

### Install or Connect ...

1. Speedo gear (71 or 72), allow to cool. Use soft-faced hammer.
2. Bearings (60 and 75), using J-22919 and hydraulic press.
3. Gears (66) and washers (65), gears (67) and washers (64).
4. Pin (63).
5. Screw (68) and washer (69), 9 N·m (84 in. lbs.). Use 5 mm allen wrench.




A. ELECTRONIC SPEEDO GEAR (72) REQUIRES HEATING PRIOR TO INSTALLATION MECHANICAL SPEEDO GEAR (71) REQUIRES HEATING (HOT TAP WATER) PRIOR TO INSTALLATION

60. BEARING, DIFFERENTIAL
61. CARRIER, ASSEMBLY DIFFERENTIAL
62. CARRIER, DIFFERENTIAL
63. PIN, CROSS DIFFERENTIAL
64. WASHER, THRUST PINION GEAR
65. WASHER, THRUST SIDE GEAR
66. GEAR, SIDE DIFFERENTIAL
67. GEAR, PINION DIFFERENTIAL
68. SCREW, 9 N·m (84 lb in.)
69. WASHER, LOCK
70. GEAR, RING DIFFERENTIAL
71. GEAR, SPEEDO (MECHANICAL)
72. GEAR, SPEEDO (ELECTRONIC)
75. BEARING, DIFFERENTIAL
77. BOLT (TEN), 83 N·m (61 lb ft)

**Figure 5-22, Differential and Ring Gear Components.**

6. Ring gear (70).
   - I.D. chamfer to carrier (61).
7. NEW bolts (77), 83 N·m (61 ft. lbs.).

## Differential Assembly Selective Shim Preload Procedure

See Figure 5-23 ...

**— IMPORTANT —**

**This procedure must be performed when any of the following components are replaced:**

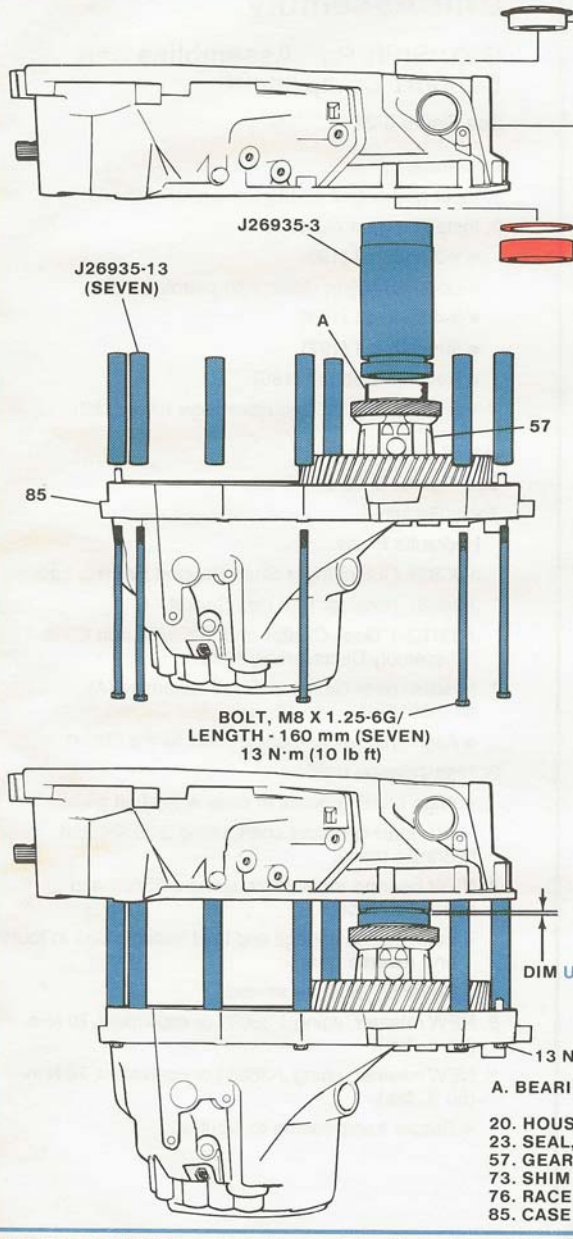
- **Transmission Case (85).**
- **Clutch and Differential Case (20).**
- **Differential Carrier (62).**
- **Differential Bearing Assemblies (58 and 74).**

### Install or Connect ...

Tools Required:

J-8092 Universal Drive Handle
J-26935 Shim Selection Set
J-26938 Axle Seal and Bearing Race Installer

1. J-26935 to clutch housing (20) and transmission housing (85).
2. Measure largest shim (73) possible in area "U"; use shim TWO SIZES LARGER (See Chart, Figure 5-23).
3. Selected shim (73).
4. Bearing race (76). Use J-26938 and J-8092 and hammer.
5. Axle seal (23). Use J-26938 and J-8092 and hammer.



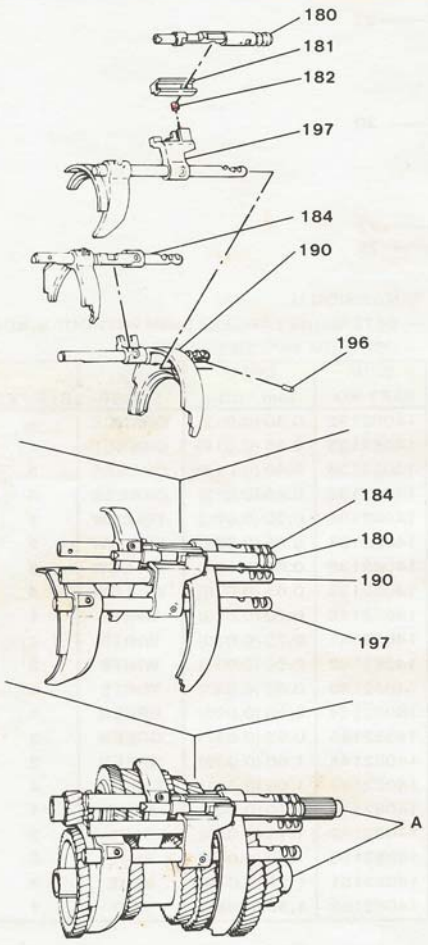

DIMENSION U
— DETERMINE LARGEST SHIM WITHOUT BINDING
— USE SHIM TWO SIZES LARGER

| SHIM PART NO. | DIM U mm (IN.) | COLOR | STRIPES |
|---|---|---|---|
| 14082132 | 0.30 (0.012) | ORANGE | 1 |
| 14082133 | 0.35 (0.014) | ORANGE | 2 |
| 14082134 | 0.40 (0.016) | ORANGE | 3 |
| 14082135 | 0.45 (0.018) | ORANGE | 4 |
| 14082136 | 0.50 (0.020) | YELLOW | 1 |
| 14082137 | 0.55 (0.022) | YELLOW | 2 |
| 14082138 | 0.60 (0.024) | YELLOW | 3 |
| 14082139 | 0.65 (0.026) | YELLOW | 4 |
| 14082140 | 0.70 (0.028) | WHITE | 1 |
| 14082141 | 0.75 (0.030) | WHITE | 2 |
| 14082142 | 0.80 (0.031) | WHITE | 3 |
| 14082143 | 0.85 (0.033) | WHITE | 4 |
| 14082144 | 0.90 (0.035) | GREEN | 1 |
| 14082145 | 0.95 (0.037) | GREEN | 2 |
| 14082146 | 1.00 (0.039) | GREEN | 3 |
| 14082147 | 1.05 (0.041) | GREEN | 4 |
| 14082148 | 1.10 (0.043) | BLUE | 1 |
| 14082149 | 1.15 (0.045) | BLUE | 2 |
| 14082150 | 1.20 (0.047) | BLUE | 3 |
| 14082151 | 1.25 (0.049) | BLUE | 4 |
| 14082152 | 1.30 (0.051) | RED | 1 |

A. BEARING CUP (76) MUST BE INSTALLED OVER BEARING

20. HOUSING, CLUTCH AND DIFFERENTIAL
23. SEAL, DRIVE AXLE
57. GEAR AND DIFFERENTIAL ASSEMBLY
73. SHIM (SELECTIVE)
76. RACE, BEARING DIFFERENTIAL
85. CASE, TRANSMISSION

**Figure 5-23, Differential Assembly Selective Shim Preload Procedure.**




A. GEAR CLUSTER AND SHIFT RAIL ASSEMBLY

180. REVERSE RAIL
181. SHIFT GATE
182. ROLLER
184. 3RD/4TH RAIL
190. 1ST/2ND RAIL
196. INTERLOCK PIN
197. 5TH RAIL

**Figure 5-24, Gear and Shift Rail Assemblies.**

# Unit Assembly

## Gear/Shift Rail Assemblies and Support Component

See Figure 5-24 ...

### Assemble ...

1. Input and output shaft gear assemblies (A).
2. Install on gear clusters:
   - 1-2 shift rail (190).
   - Lock pin (196); retain with petroleum jelly.
   - 3-4 shift rail (184).
   - 5th shift rail (197).
   - Reverse shift rail (180).
   - Shift gate (181) and disengage roller (182).

### Install or Connect ...

See Figures 5-25 and 5-26 ...

Tools Required:

Hydraulic Press

J-35824 Output/Input Shaft Support Bearing Installer

J-36031 Retainer Bolt Hex Socket

J-36182-1 Gear Cluster and Transmission Case Assembly/Disassembly Pallet

1. Position gear cluster/shift rail assembly (A) on J-36182-1.
   - Align shift rail and shaft pilots to the fixture.
2. Transmission case.
   - Align bearing bores in case with shaft pilots.
3. NEW bearing output shaft, using J-35824 and hydraulic press.
4. NEW bearing input shaft, using J-35824 and hydraulic press.
   - Push rails to engage and hold transmission in fourth and reverse gear.
   - Bearings must be seated.
5. NEW retainer, using J-36031 or equivalent, 70 N·m (50 ft. lbs.).
6. NEW retainer, using J-36031 or equivalent, 70 N·m (50 ft. lbs.).
   - Return transmission to Neutral.

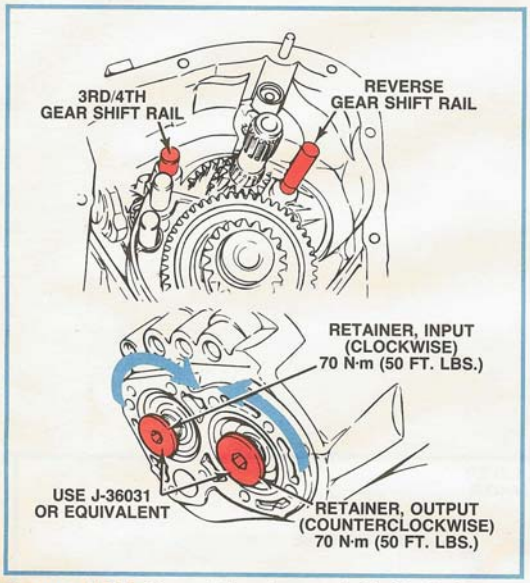



Figure 5-25, Gear Cluster and Shift Rail Assembly Installation.

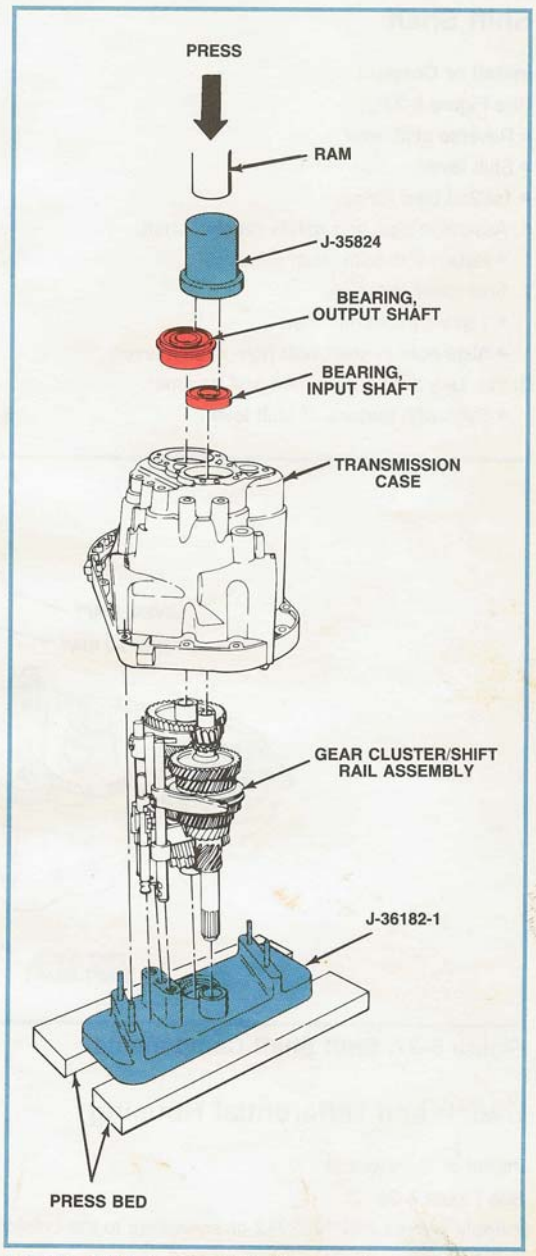



Figure 5-26, Engaging Transmission in Gear Shaft Support Components Installation.

## Shift Shaft

### Install or Connect ...

See Figure 5-27 ...

- Reverse shift lever.
- Shift lever.
- 1st/2nd bias spring.

1. Assemble pins and rollers on shift shaft.
   - Retain with petroleum jelly.
2. Shift shaft assembly.
   - Tap with light hammer.
   - Align hole in shaft with hole in shift lever.
3. Pin. Use a 3/16-in. punch and hammer.
   - Even with surface of shift lever.

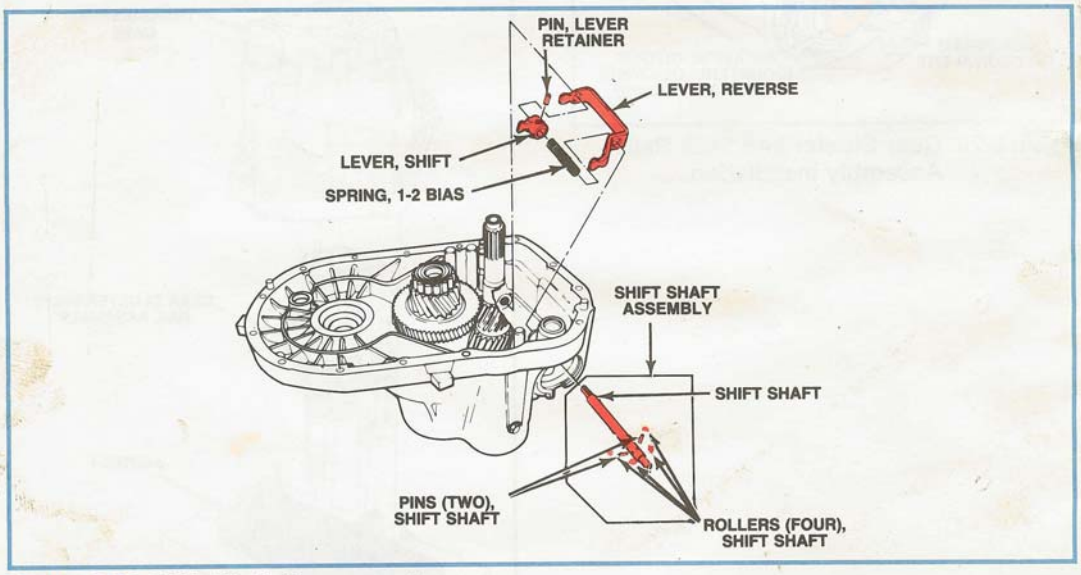



**Figure 5-27, Shift Shaft Components.**

## Clutch and Differential Housing

### Install or Connect ...

See Figure 5-28 ...

- Apply sealant P/N 1052942 or equivalent to the outside of the bolt hole pattern of the gear case flange.

1. Differential.
2. Bearing. Note position of cage.
   - SMALL I.D. DIAMETER OF BEARING CAGE TOWARD CLUTCH HOUSING.

3. Magnet.
4. Clutch housing.
5. Bolts, 21 N·m (15 ft. lbs.). Use 13 mm socket and driver.

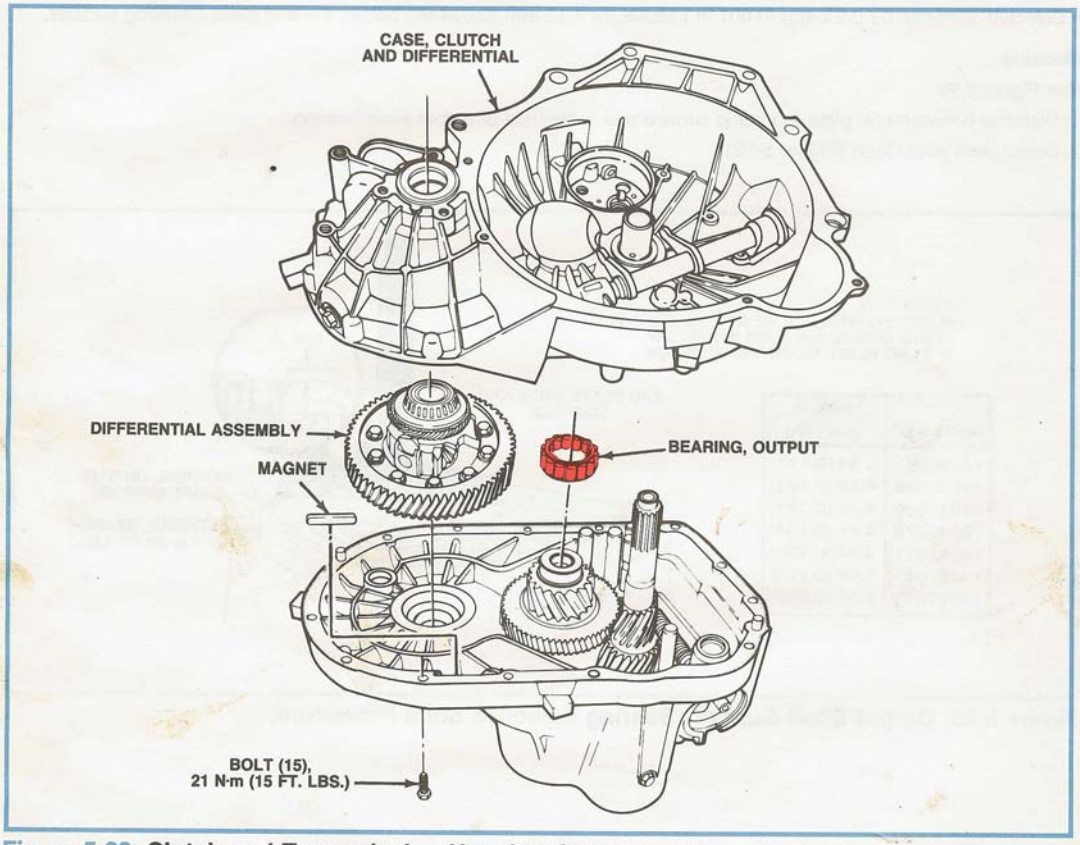



**Figure 5-28, Clutch and Transmission Housing Components.**

## Output Shaft Support Bearing Selective Shim Procedure

Tool Required – J-26900-19 Metric Dial Depth Gauge or Equivalent.

- Be sure OUTPUT BEARING is seated in bore.
- Be sure bearing RETAINER is properly torqued.
- Selected shim can be 0.03 mm (0.001 in.) above, or 1.12 mm (0.004 in.) below, the end plate mounting surface.

**Measure ...**

See Figure 5-29 ...

1. Distance between end plate mounting surface and outer race of output shaft bearing.
2. Select shim from Chart (Figure 5-29).

DIMENSION A
- SELECTED SHIM CAN BE 0.03 mm (0.001 IN.) ABOVE OR 0.12 mm (0.004 IN.) BELOW THE END PLATE MOUNTING SURFACE.

| PART NO. | DIM. A mm (IN.) |
|---|---|
| 14092067 | 4.54 (0.179) |
| 14092068 | 4.64 (0.183) |
| 14092069 | 4.74 (0.187) |
| 14092070 | 4.84 (0.191) |
| 14092071 | 4.94 (0.194) |
| 14092072 | 5.04 (0.198) |
| 14092073 | 5.14 (0.202) |

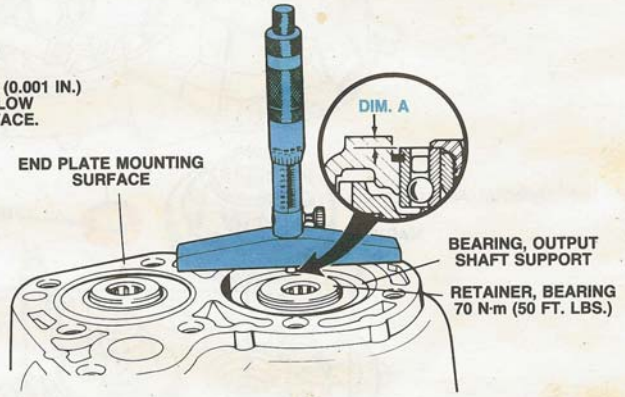



**Figure 5-29, Output Shaft Support Bearing Selective Shim Procedure.**

## Transmission Case End Plate

**Install or Connect ...**

See Figure 5-30 ...

- Apply sealant P/N 1052942 or equivalent to the outside end plate bolt hole pattern of case.

1. Shim.
2. Oil Shield.
3. End cover plate.
4. Bolts, 21 N·m (15 ft. lbs.). Use 13 mm socket and driver.

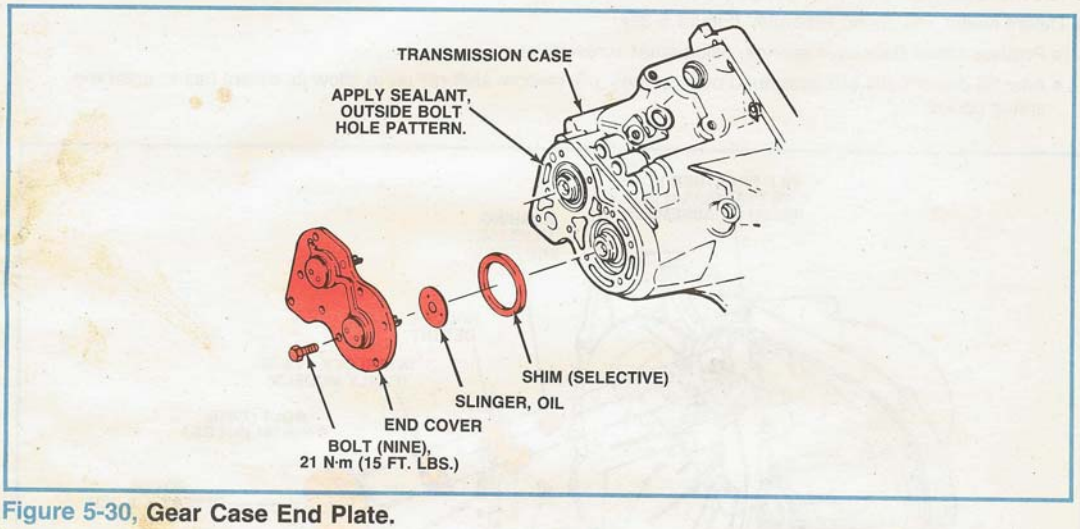



**Figure 5-30, Gear Case End Plate.**

## Shift Rail Detent/Clutch and Differential Housing

See Figures 5-31, 5-32, and 5-33 ...

### Install or Connect ...

- Position shift rails to expose interlock notches (Neutral position).
- Position reverse shift rail to allow the detent ball to sit in the notch and on reverse bushing.

1. Reverse bushing. Use suitable socket.
2. Detent balls.
   - Place in notched areas of shift rails (retain ball positions with petroleum jelly).
3. Assemble interlock pins and springs into bores in detent holder.
4. Detent holder and spring assembly (Figure 5-32).
   - Position detent balls over springs, using small screwdriver.
   - After all detent balls are positioned over springs, pry reverse shift rail up to allow its detent ball to enter the spring pocket.

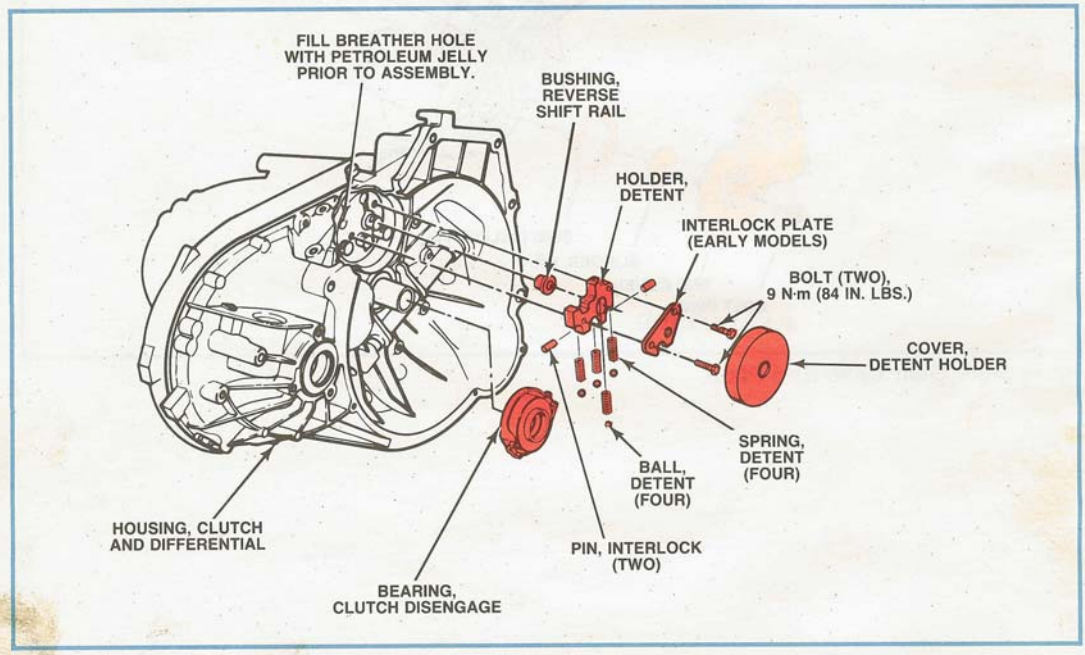



**Figure 5-31, Shift Rail Detent Components/Clutch and Differential Housing.**

5. Position holder, using pry to align bolt holes with threads.
   - Interlock plate (early models) (VIEW B).
6. Bolts, 9.0 N·m (84 in. lbs.). Use 10 mm socket and driver.
7. Protective cover.
   - Tap with hammer until seated in bore.
8. Bearing.
   - Apply high-temperature grease to inside bore.

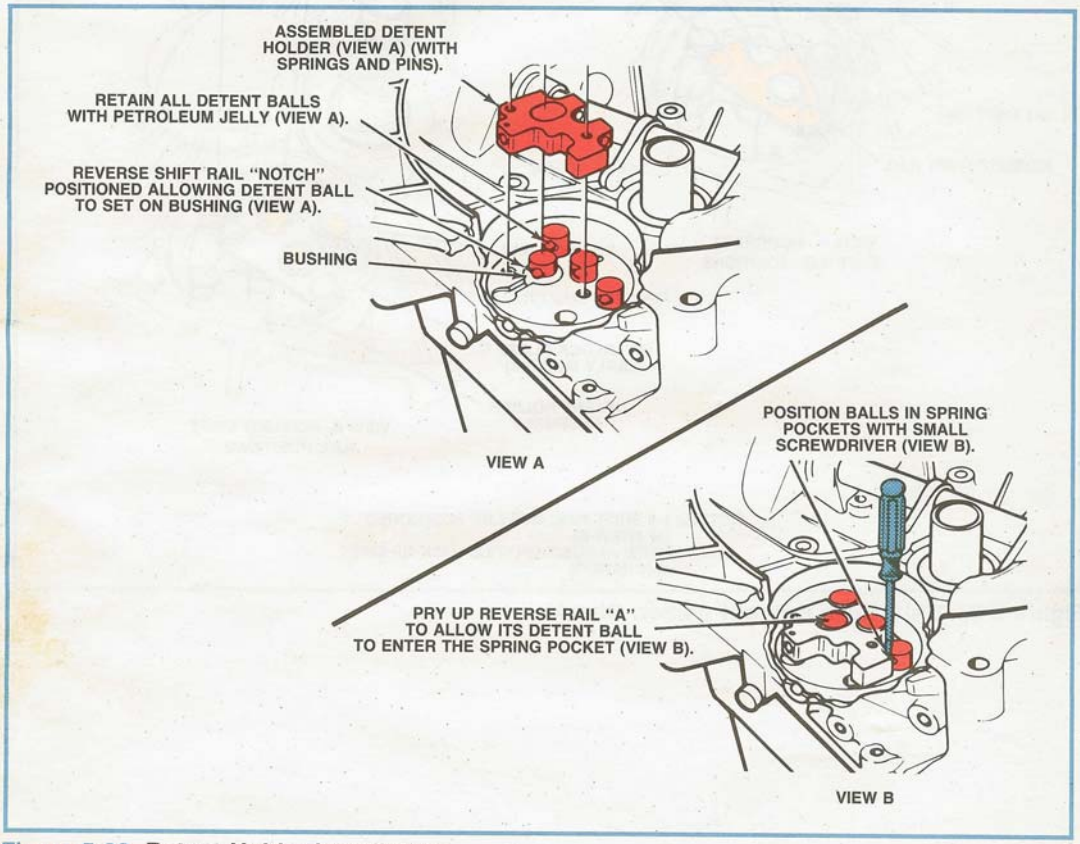



**Figure 5-32, Detent Holder Installation.**

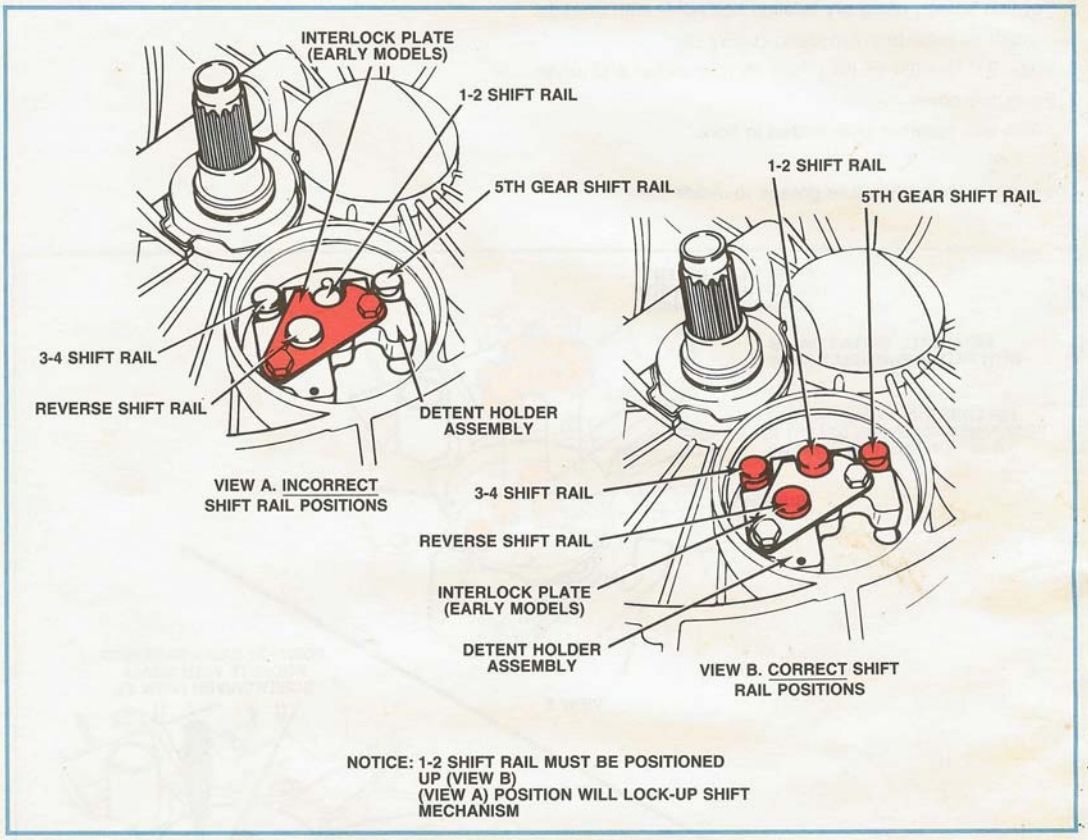



**Figure 5-33, Shift Rails Detent Position Check.**

## Shift Shaft Detent/Transmission Housing

See Figure 5-34 ...

### Install or Connect ...

1. Spring seat, inner.
2. 5th/Rev. bias spring.
3. Spring seat, outer.
4. Screw. Use 5 mm allen wrench.
   - Use small amount of thread sealant GM P/N 1052624 or equivalent, 9.0 N·m (84 in. lbs.).
5. Protective cover. Use hammer.
   - Position to below snap ring groove.
6. Snap ring. Use screwdriver.

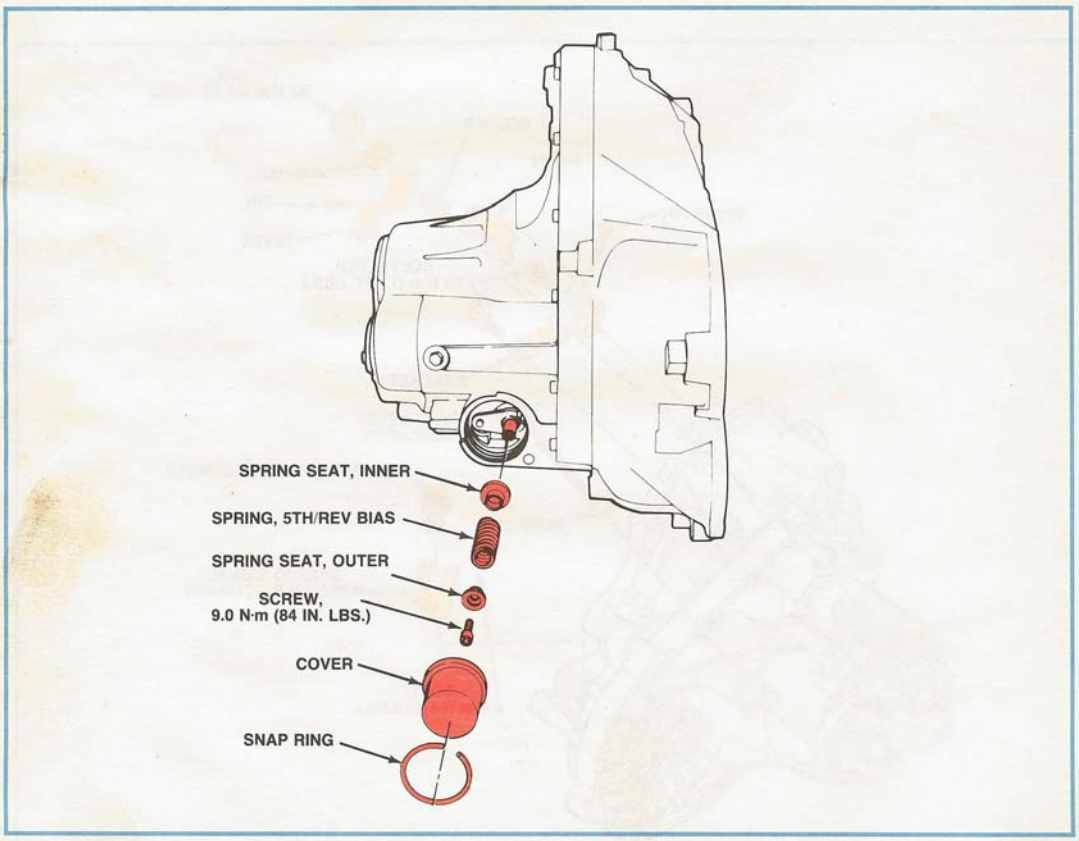



**Figure 5-34, Shift Shaft Detent Components/Transmission Housing.**

## External Transaxle Mounted Linkage Installation

See Figure 5-35 ...

### Install or Connect ...

1. Bracket.
2. Bolts. Use 13 mm socket and driver, 23 N·m (17 ft. lbs.).
3. Collar and pin. Use punch and hammer.
4. Pivot.
5. NEW pin, if certain type.
6. Lever.
7. Washer and nut. Use 21 mm socket and driver.
   - 83 N·m (61 ft. lbs.).
   - DO NOT ALLOW lever to move during installation of nut.

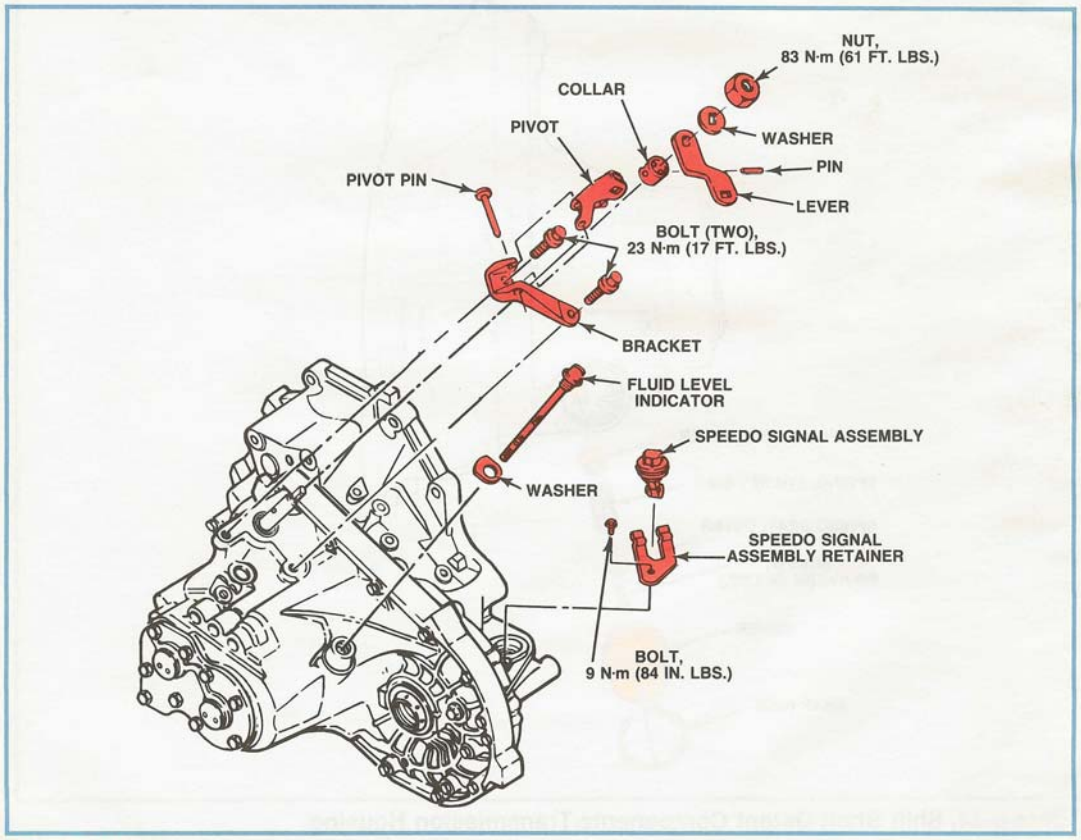



**Figure 5-35, External Transaxle Mounted Linkage.**

8. Fluid level indicator and NEW washer.
9. Electronic Speedo sensor assembly, retainer and bolt. Use 10 mm socket and driver, 9 N·m (84 in. lbs.).

## Torque Specifications

| P/N* | DESCRIPTION OF USAGE | TORQUE |
|---|---|---|
| 18 | Reverse shift rail guide | 21 N·m (15 ft. lbs.) |
| 68 | Differential pin | 9 N·m (84 ft. lbs.) |
| 77 | Differential gear | 83 N·m (61 ft. lbs.) |
| 79 | Fluid drain plug | 24 N·m (18 ft. lbs.) |
| 81 | Clutch housing to gear housing | 21 N·m (15 ft. lbs.) |
| 83 | Alternate oil level check/fill plug | 24 N·m (18 ft. lbs.) |
| 88 | Output shaft bearing support | 70 N·m (50 ft. lbs.) |
| 91 | End plate to gear housing | 21 N·m (15 ft. lbs.) |
| 92 | Input shaft bearing support | 70 N·m (50 ft. lbs.) |
| 94 | Reverse idler gear bracket | 21 N·m (15 ft. lbs.) |
| (123 or 132) | Shift pivot bracket | 23 N·m (17 ft. lbs.) |
| (129 or 137) | Shift lever nut | 83 N·m (61 ft. lbs.) |
| 141 | Shift shaft detent | 9 N·m (84 in. lbs.) |
| 159 | Interlock plate | 21 N·m (15 ft. lbs.) |
| 169 | Shift rail detent holder | 9 N·m (84 in. lbs.) |
| 179 | Output bearing race | 21 N·m (15 ft. lbs.) |
| 205 | Sliding sleeve detent | 44 N·m (32 ft. lbs.) |
| 211 | Stud | 21 N·m (15 ft. lbs.) |
| 212 | Electronic speed sensor retainer | 9 N·m (84 in. lbs.) |

*Disassembled Parts Illustration, Section 1, pages 1-34 to 1-37.

### LUBRICANT SPECIFICATIONS

Recommended Lube ..... P/N 1052931 or Equivalent

Lube Capacity (Approximate)
A and P Carlines ..... 1.9 Liters (2 Quarts)
J, L, N and W Carlines ..... 2.1 Liters (5 Pints)

## Special Tools

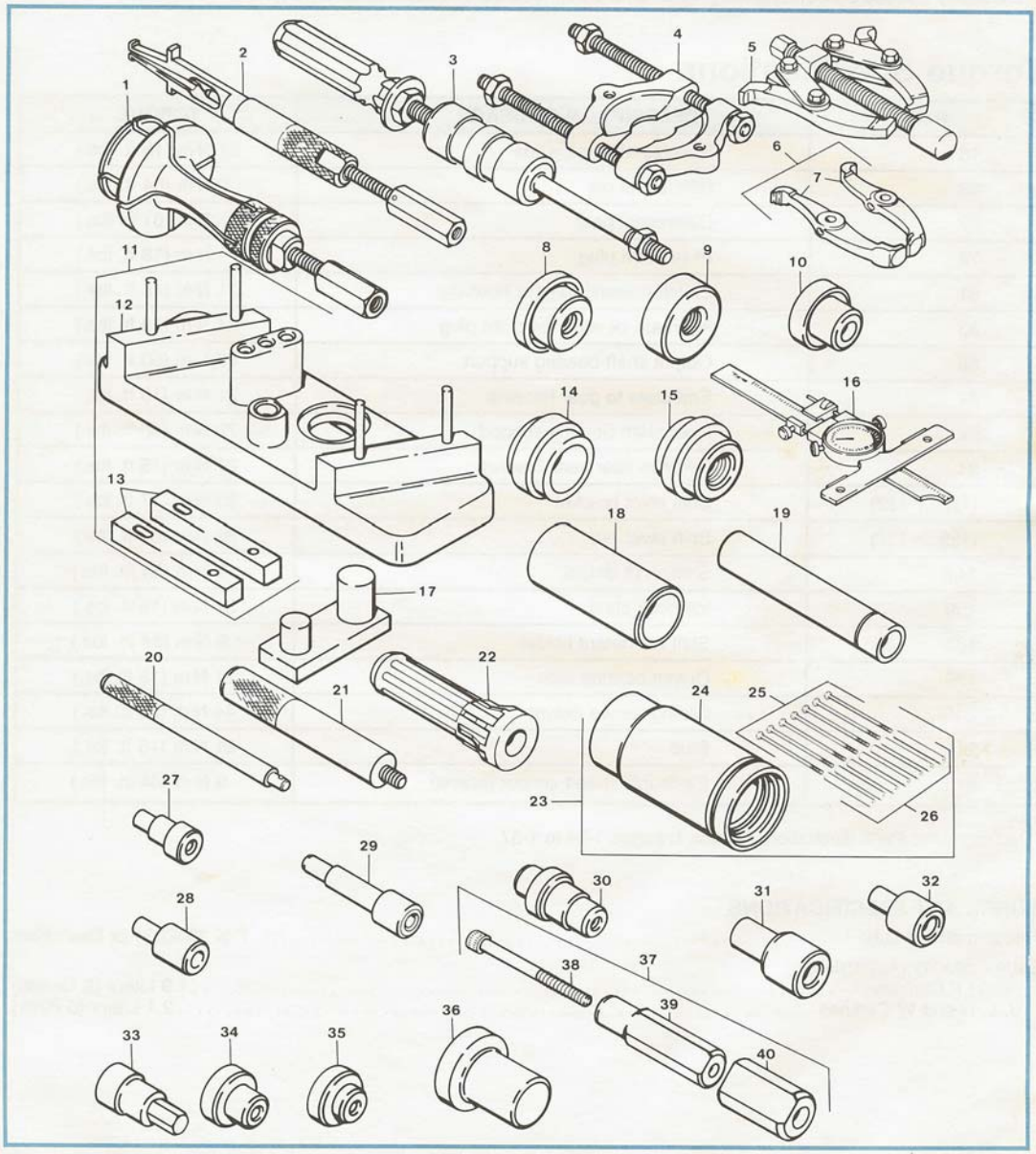



Figure 5-36, **Special Tools, Muncie (5-Speed) Transaxle.**

SPECIAL TOOLS MUNCIE (5-SPEED) TRANSAXLE

| TOOL NUMBER | TOOL NAME | ITEM NUMBER |
|---|---|---|
| J8092 | UNIVERSAL DRIVER HANDLE | 21 |
| J2241-11 | SIDE BEARING PULLER ADAPTER, DIFFERENTIAL | 34 |
| J22888 | BEARING REMOVER | 5 |
| J22888-35 | BEARING REMOVER LEG (TWO) | 7 |
| J22888-50 | BEARING REMOVER LEG SET | 6 |
| J22912-01 | INPUT/OUTPUT SHAFT GEARS REMOVER | 4 |
| J22919 | DIFFERENTIAL INNER BEARING INSTALLER | 10 |
| J23423-A | DIFFERENTIAL AND OUTPUT SHAFT BEARING CUP INSTALLER | 15 |
| J23598 | SIDE BEARING PULLER ADAPTER, DIFFERENTIAL | 35 |
| J23907 | SLIDE HAMMER AND ADAPTER SET | 3 |
| J26900-19 | METRIC DIAL DEPTH GAGE | 16 |
| J26935 | SHIM SELECTION SET | 23 |
| J26935-3 | DIFFERENTIAL SHIMMING GAGE | 24 |
| J26935-13 | SHIM SELECTION SET SPACERS (SEVEN) | 26 |
| | BOLTS, M8 x 1.25-6G / LENGTH - 160 mm (SEVEN) | 25 |
| J26938 | SEAL AND RACE, DIFFERENTIAL, INSTALLER | 8 |
| J35823 | SHIFT SHAFT SEAL INSTALLER | 22 |
| J35824 | INPUT BEARING ASSEMBLY REMOVER/INSTALLER/SHAFT SUPPORT BEARING INSTALLER | 36 |
| J36027 | SHIFT SHAFT BEARING REMOVER | 27 |
| J36029 | SHIFT RAIL BUSHING REMOVER/INSTALLER | 37 |
| J36029-1 | ADAPTER TO DRIVE HANDLE | 40 |
| J36029-2 | INSTALL/REMOVER ADAPTER | 39 |
| | CAP SCREW, 1/4-20 x 2 1/2 | 38 |
| J36030 | REVERSE SHIFT RAIL BUSHING INSTALLER | 28 |
| J36031 | BEARING RETAINER BOLT HEX SOCKET | 33 |
| J36032 | CLUTCH SHAFT INNER REVERSE SHIFT RAIL BUSHING REMOVER | 2 |
| J36033 | CLUTCH SHAFT INNER BUSHING INSTALLER | 31 |
| J36034 | SLIDING SLEEVE BUSHING REMOVER/INSTALLER | 29 |
| J36037 | CLUTCH SHAFT UPPER BUSHING REMOVER/INSTALLER | 19 |
| J36038 | OUTPUT SHAFT BEARING CUP REMOVER | 1 |
| J36039 | SHIFT DETENT LEVER BUSHING REMOVER/INSTALLER | 30 |
| J36181 | DIFFERENTIAL BEARING CUP REMOVER | 9 |
| J36182 | INPUT/OUTPUT SHAFT REMOVER/INSTALLER ASSEMBLY SET | 11 |
| J36182-1 | PALLET | 12 |
| J36182-2 | DISASSEMBLY ADAPTER (TWO) | 13 |
| J36183 | INPUT SHAFT REMOVER/INSTALLER PRESS TUBE | 18 |
| J36184 | OUTPUT SHAFT REMOVER/INSTALLER ADAPTER PRESS TUBE REDUCER | 14 |
| J36185 | INPUT/OUTPUT SHAFT BEARING REMOVER | 17 |
| J36189 | SHIFT SHAFT BEARING INSTALLER | 32 |
| J36190 | UNIVERSAL DRIVER HANDLE | 20 |

ITEM NUMBER/TOOL NUMBER CROSS REFERENCE

| | |
|---|---|
| 1 - J36038 | 21 - J8092 |
| 2 - J36032 | 22 - J35823 |
| 3 - J23907 | 23 - J26935 |
| 4 - J22912-01 | 24 - J26935-3 |
| 5 - J22888 | 25 - BOLTS (SEVEN) |
| 6 - J22888-50 | 26 - J26935-13 (SEVEN) |
| 7 - J22888-35 | 27 - J36027 |
| 8 - J26938 | 28 - J36030 |
| 9 - J36181 | 29 - J36034 |
| 10 - J22919 | 30 - J36039 |
| 11 - J36182 | 31 - J36033 |
| 12 - J36182-1 | 32 - J36189 |
| 13 - J36182-2 | 33 - J36031 |
| 14 - J36184 | 34 - J2241-11 |
| 15 - J23423-A | 35 - J23598 |
| 16 - J26900-19 | 36 - J35824 |
| 17 - J36185 | 37 - J36029 |
| 18 - J36183 | 38 - CAP SCREW |
| 19 - J36037 | 39 - J36029-2 |
| 20 - J36190 | 40 - J36029-1 |

**Figure 5-36, Special Tools, Muncie (5-Speed) Transaxle, Continued.**

# 6. Reference

## Bulletin History

| DATE | BULLETIN | DESCRIPTION |
|---|---|---|
| • 6-86 | Pontiac 86-7-30 | Exchange program for MG282. |
| • 9-86 | Pontiac 86-C-07 | Campaign – Interlock plate installation on 1986 Fiero only. |
| • 9-86 | Buick 87-7-2 | Exchange program for MG282. |
| • 10-86 | Oldsmobile 87-T-04 | Exchange program for MG282. |
| • 10-86 | Cadillac 87-23 | Exchange program for MG282. |
| • 12-86 | Chevrolet 87-24 | Exchange program for MG282. |

## Notes

## Notes

GM

Product
Service
Training

# 17004.04-1


APRIL 1987
GENERAL MOTORS CORPORATION

LITHO IN U.S.A.