

SECTION 7B-10B

BORG-WARNER (T56) UNIT REPAIR

RPO MM6

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

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GENERAL DESCRIPTION

To ensure good fuel economy and compliance with federal fuel economy standards, 2nd and 3rd gears are inhibited when shifting out of 1st gear under the following conditions:

- Coolant temperature is above 77°C (161°F).
- Throttle is opened 35% or less.
- Vehicle speed is between 24 and 34 kmh (15 and 21 mph).
- Reset at less than 2 kmh (1 mph).

UNIT DISASSEMBLY

A complete disassembled view is shown on page 2.

SHIFTER

Figures 3 and 4

Tools Required:

- J 3289-20 Holding Fixture Bench Mount
- J 39430 Transmission Support Fixture



Remove or Disconnect

1. Vent tube (161).
2. Clutch housing bolts (163).
3. Clutch housing (162).
4. Clutch fork bolt (166).
5. Clutch fork (164) and T-handle (165).
6. Install transmission to J 39430 and J 3289-20.
 - Use bolts (163) to secure transmission to J 39430.

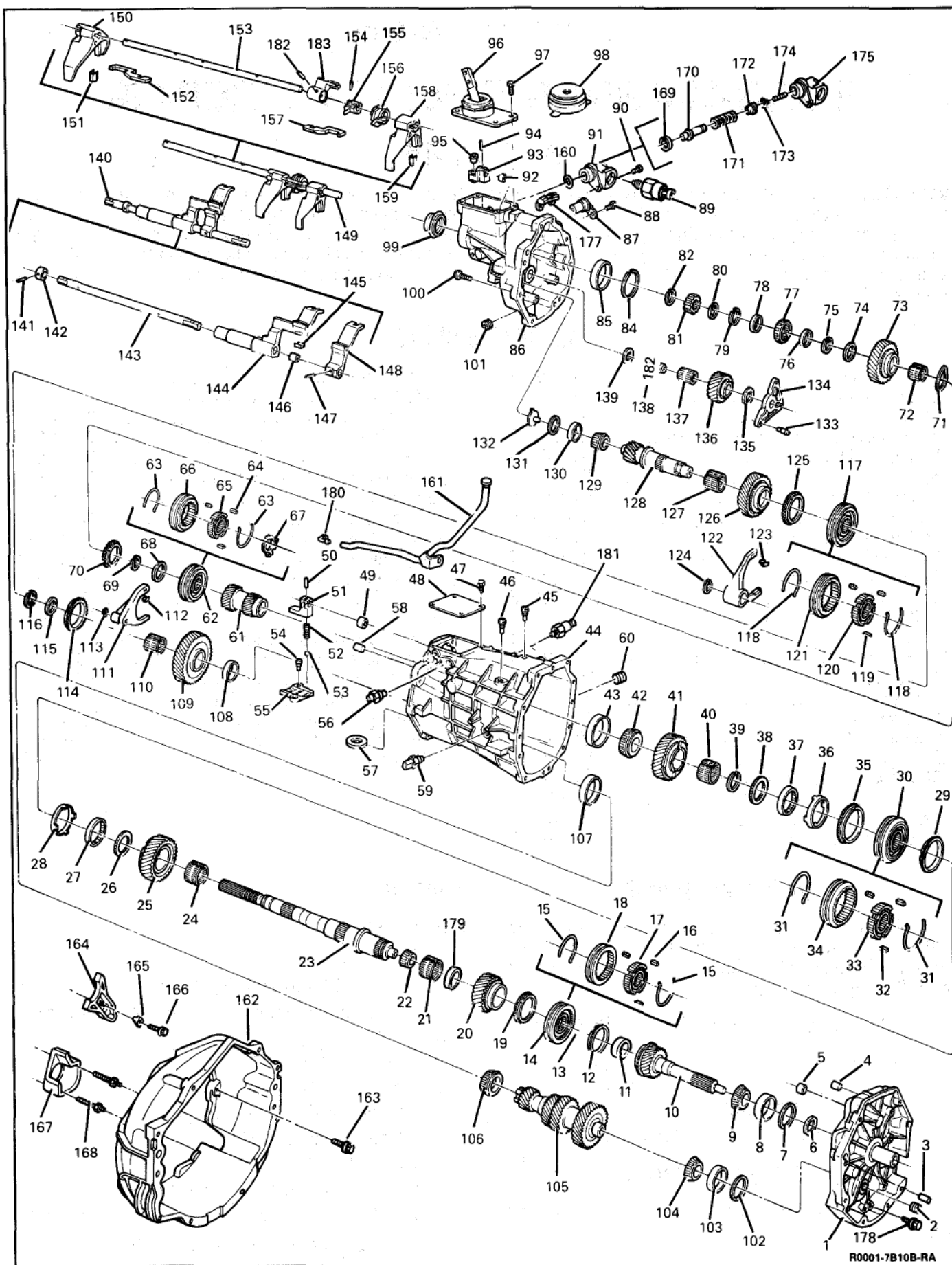


Figure 1 Disassembled View

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1	PLATE, TRANSMISSION ADAPTER	67	RETAINER, REVERSE SYNCHRONIZER KEY	129	BEARING, COUNTERSHAFT EXTENSION TAPERED
2	PLUG	68	WASHER, THRUST	130	RACE, COUNTERSHAFT EXTENSION BEARING
3	PIN, DOWEL	69	RING, SNAP	131	SHIM, COUNTERSHAFT EXTENSION
4	PIN, DOWEL	70	RING, REVERSE GEAR BLOCKER	132	FUNNEL, OIL
5	BUSHING, SHIFT RAIL	71	WASHER, WAVE	133	BOLT, REVERSE IDLER SHAFT BRACKET
6	SEAL, INPUT SHAFT	72	BEARING, REVERSE GEAR NEEDLE	134	BRACKET, REVERSE IDLER SHAFT
7	SHIM, INPUT SHAFT	73	GEAR, REVERSE	135	WASHER, REVERSE IDLER GEAR THRUST
8	RACE, INPUT SHAFT BEARING	74	WASHER, THRUST	136	GEAR, REVERSE IDLER
9	BEARING, INPUT SHAFT TAPERED	75	RING, SNAP	137	BEARING, REVERSE IDLER GEAR ROLLER
10	SHAFT, INPUT	76	SPACER	138	SHAFT, REVERSE IDLER GEAR
11	RACE, INPUT SHAFT BEARING	77	BEARING, REAR MAINSHAFT	139	WASHER, REVERSE IDLER GEAR THRUST
12	RING, 4TH GEAR BLOCKER	78	SPACER	140	RAIL ASSEMBLY, 5TH/6TH SHIFT
13	RING, SNAP	79	RING, SNAP	141	PIN, ROLL
14	SYNCHRONIZER ASSEMBLY, 3RD/4TH	80	RING, SNAP	142	COLLAR
15	SPRING, 3RD/4TH SYNCHRONIZER	81	GEAR, SPEEDOMETER (ELECTRONIC)	143	RAIL, SHIFT
16	KEY, 3RD/4TH SYNCHRONIZER	82	RING, SNAP	144	LEVER, 5TH/6TH SHIFT RAIL
17	HUB, 3RD/4TH SYNCHRONIZER	84	RING, SNAP	145	PAD, 5TH/6TH SHIFT RAIL LEVER
18	SLEEVE, 3RD/4TH SYNCHRONIZER	85	RACE, MAINSHAFT BEARING	146	BUSHING, 5TH/6TH SHIFT RAIL LEVER
19	RING, 3RD GEAR BLOCKER	86	HOUSING, TRANSMISSION EXTENSION	147	PIN, ROLL
20	GEAR, 3RD SPEED	87	SENSOR, ELECTRONIC SPEED	148	LEVER, REVERSE SHIFT RAIL
21	BEARING, 3RD GEAR NEEDLE	88	BOLT, SPEED SENSOR	149	RAIL ASSEMBLY, 1ST/2ND 3RD/4TH SHIFT
22	BEARING, MAINSHAFT SMALL TAPERED	89	SOLENOID, REVERSE LOCKOUT	150	FORK, 1ST/2ND SHIFT
23	MAINSHAFT	90	BOLT, REVERSE LOCKOUT ASSEMBLY	151	PAD, 1ST/2ND SHIFT FORK
24	BEARING, 2ND GEAR NEEDLE	91	BODY ASSEMBLY, REVERSE LOCKOUT	152	LINK, SHIFT
25	GEAR, 2ND SPEED	92	BUSHING, SHIFT RAIL	153	RAIL ASSEMBLY, 1ST/2ND 3RD/4TH SHIFT
26	WASHER, THRUST	93	LEVER, REAR OFFSET SHIFT	154	PIN, ROLL
27	CONE, INNER	94	PIN, REAR OFFSET SHIFT LEVER ROLL	155	PIN, SELECTOR
28	CONE, FRICTION	95	CUP, ISOLATOR	156	PLATE, INTERLOCK
29	RING, 2ND GEAR BLOCKER	96	SHIFTER ASSEMBLY	157	LINK, SHIFT
30	SYNCHRONIZER ASSEMBLY, 1ST/2ND	97	BOLT, SHIFTER ASSEMBLY	158	FORK, 3RD/4TH SHIFT
31	SPRING, 1ST/2ND SYNCHRONIZER	98	BOOT, SHIFTER	159	PAD, 3RD/4TH SHIFT FORK
32	KEY, 1ST/2ND SYNCHRONIZER	99	SEAL AND BOOT, REAR OUTPUT	160	O-RING, REVERSE LOCKOUT ASSEMBLY
33	HUB, 1ST/2ND SYNCHRONIZER	100	BOLT, TRANSMISSION EXTENSION HOUSING	161	TUBE, VENT
34	SLEEVE, 1ST/2ND SYNCHRONIZER	101	PLUG, DRAIN	162	HOUSING, CLUTCH ADAPTER
35	RING, 1ST GEAR BLOCKER	102	SHIM, COUNTERSHAFT	163	BOLT, CLUTCH ADAPTER HOUSING
36	CONE, FRICTION	103	RACE, COUNTERSHAFT BEARING	164	FORK, CLUTCH
37	CONE, INNER	104	BEARING, COUNTERSHAFT TAPERED	165	T-HANDLE, CLUTCH FORK PIVOT
38	WASHER, THRUST	105	COUNTERSHAFT	166	BOLT, CLUTCH FORK PIVOT
39	RING, SNAP	106	BEARING, COUNTERSHAFT TAPERED	167	HOUSING, CLUTCH ACTUATOR ADAPTER
40	BEARING, 1ST GEAR NEEDLE	107	RACE, COUNTERSHAFT BEARING	168	BOLT, CLUTCH ACTUATOR ADAPTER HOUSING
41	GEAR, 1ST SPEED	108	WASHER, THRUST	169	RING, SNAP
42	BEARING, MAINSHAFT LARGE TAPERED	109	GEAR, 6TH DRIVE	170	PLUNGER, REVERSE LOCKOUT
43	RACE, MAINSHAFT BEARING	110	BEARING, 6TH GEAR NEEDLE	171	SPRING, REVERSE LOCKOUT OUTER
44	CASE, TRANSMISSION	111	FORK, REVERSE SHIFT	172	COLLAR, REVERSE LOCKOUT
45	BOLT, SHIFT LEVER GUIDE	112	PAD, REVERSE SHIFT FORK	173	RING, SNAP
46	BOLT, SHIFT LEVER GUIDE	113	RING, SNAP	174	SPRING, REVERSE LOCKOUT INNER
47	BOLT, SHIFT DETENT COVER	114	RING, 6TH GEAR BLOCKER	175	BODY, REVERSE LOCKOUT
48	COVER, SHIFT DETENT	115	SPACER	176	BODY, REVERSE LOCKOUT
49	BUSHING, SHIFT RAIL	116	RING, SNAP	177	BUMPER, TRANSMISSION
50	PIN, FRONT OFFSET LEVER ROLL	117	SYNCHRONIZER ASSEMBLY, 5TH/6TH	178	BOLT, TRANSMISSION ADAPTER PLATE
51	LEVER, FRONT OFFSET	118	SPRING, 5TH/6TH SYNCHRONIZER	179	SPACER
52	SPRING, SHIFT DETENT	119	KEY, 5TH/6TH SYNCHRONIZER	180	FITTING, VENT TUBE
53	BALL, SHIFT DETENT	120	HUB, 5TH/6TH SYNCHRONIZER	181	SOLENOID, COMPUTER AIDED GEAR SELECT
54	BOLT, SHIFT GUIDEPLATE	121	SLEEVE, 5TH/6TH SYNCHRONIZER	182	PIN, ROLL
55	PLATE, SHIFT GUIDE	122	FORK, 5TH/6TH SHIFT	183	LEVER, COMPUTER AIDED GEAR SELECT SOLENOID
56	DETENT ASSEMBLY, SHIFT	123	PAD, 5TH/6TH SHIFT FORK		
57	MAGNET	124	RING, SNAP		
58	PIN, DOWEL	125	RING, 5TH GEAR BLOCKER		
59	SWITCH, BACK-UP LAMP	126	GEAR, 5TH DRIVE		
60	PLUG, FILL	127	BEARING, 5TH GEAR NEEDLE		
61	GEAR, 5TH/6TH DRIVEN	128	EXTENSION, COUNTERSHAFT		
62	SYNCHRONIZER ASSEMBLY, REVERSE				
63	SPRING, REVERSE SYNCHRONIZER				
64	KEY, REVERSE SYNCHRONIZER				
65	HUB, REVERSE SYNCHRONIZER				
66	SLEEVE, REVERSE SYNCHRONIZER				

Figure 2 Disassembled View – Legend

7. Rotate transmission in horizontal position, shifter up.
8. Plug (101) and drain transmission fluid.
9. Put transmission in 3rd/4th neutral position.
10. Shifter bolts (97).
11. Shifter (96).

Inspect

- Isolator cup (95) for wear. Replace rear offset shift lever (93) if wear is excessive or isolator cup (95) is loose.

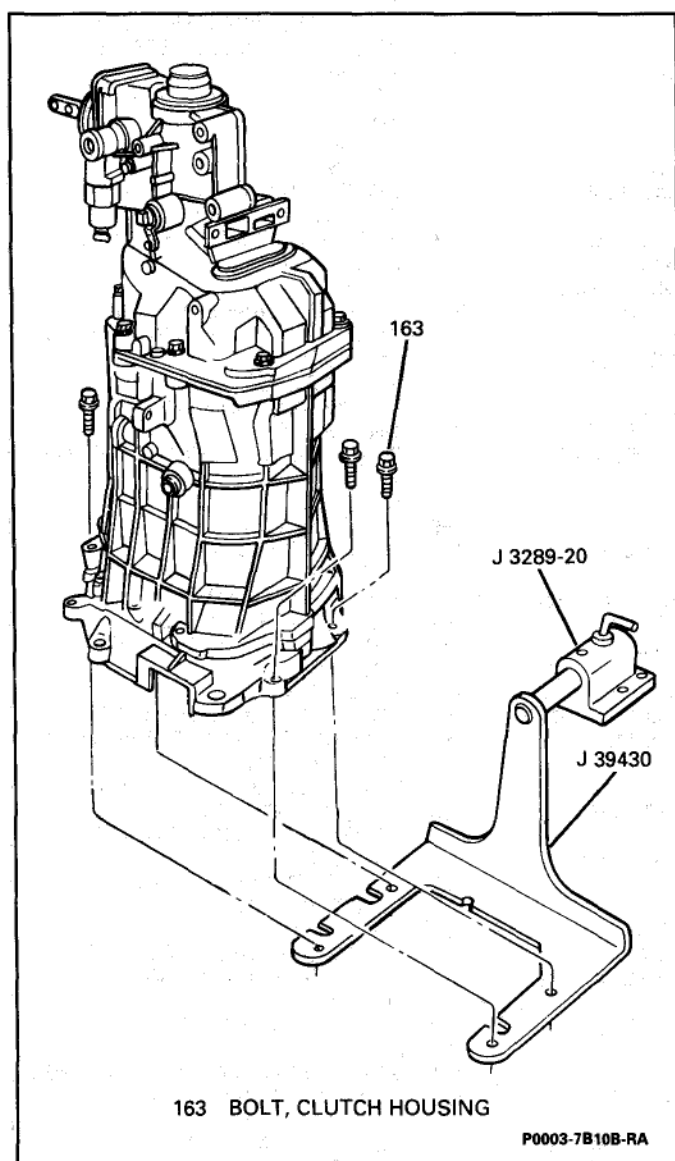


Figure 3 Transmission Support Fixture

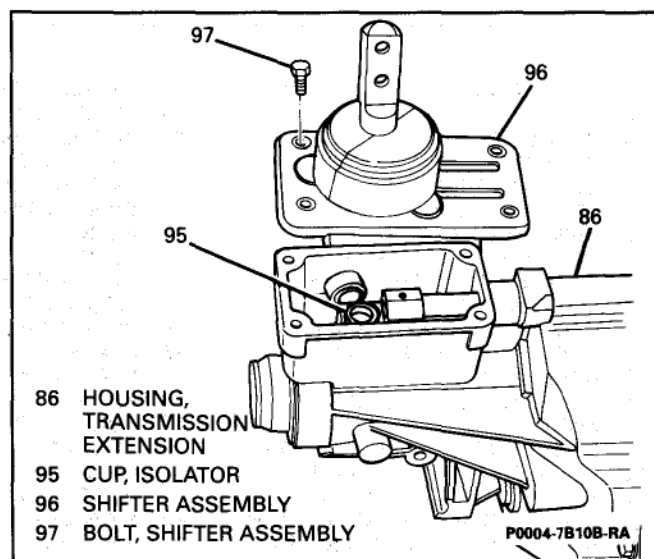


Figure 4 Shifter

EXTENSION HOUSING

Figure 5

Remove or Disconnect

1. Rear offset shift lever roll pin (94).

Important

- If isolator cup (95) is not fully retained in rear offset lever with adhesive, replace rear offset lever assembly (93).
2. Rear offset shift lever (93) and isolator cup (95) assembly.
 3. Extension housing bolts (100).
 4. Extension housing (86).
- With transmission in horizontal position, slide extension housing (86) off shift rails (140 and 149).

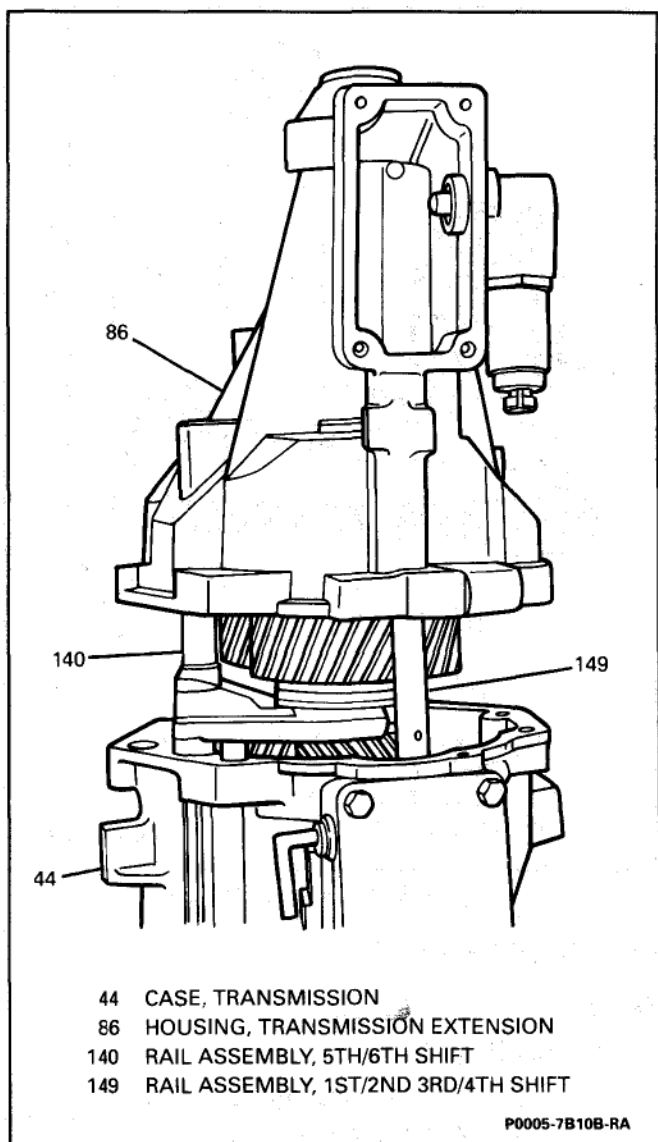


Figure 5 Extension Housing

SPEEDOMETER GEAR

Figure 6

Tools Required:

- J 8433 Universal Bridge Puller
- J 39431 Gear Remover
- J 39431-1 Gear Remover Bolts

Remove or Disconnect

1. Rotate transmission in vertical position.
2. Sealing ring.
3. Speedometer gear snap ring (82).
4. Speedometer gear (81) using J 8433, J 39431 and J 39431-1.
 - A. Set J 8433 onto nose of main shaft (23).
 - B. Slide J 39431 under speedometer gear.
 - C. Install bolts J 39431-1 to J 39431.
 - D. Speedometer gear (81) using J 8433, J 39431 and J 39431-1.
5. Speedometer gear snap ring (80).

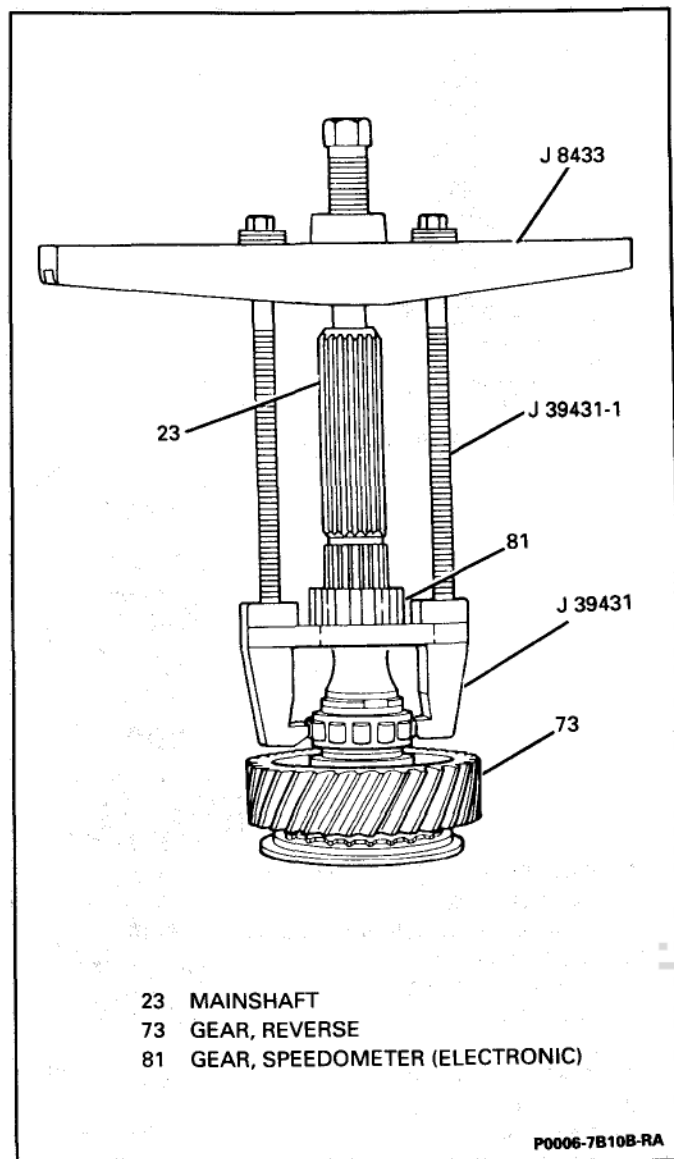


Figure 6 Speedometer Gear

REVERSE SPEED GEAR

Figure 7

Remove or Disconnect

1. Roller bearing snap ring (79).
2. Spacer (78).
3. Roller bearing (77).
4. Spacer (76).
5. Snap ring (75).
6. Thrust washer (74).
7. Reverse speed gear (73).
8. Caged needle bearing (72).
9. Wave washer (71).
10. Blocker ring (70).

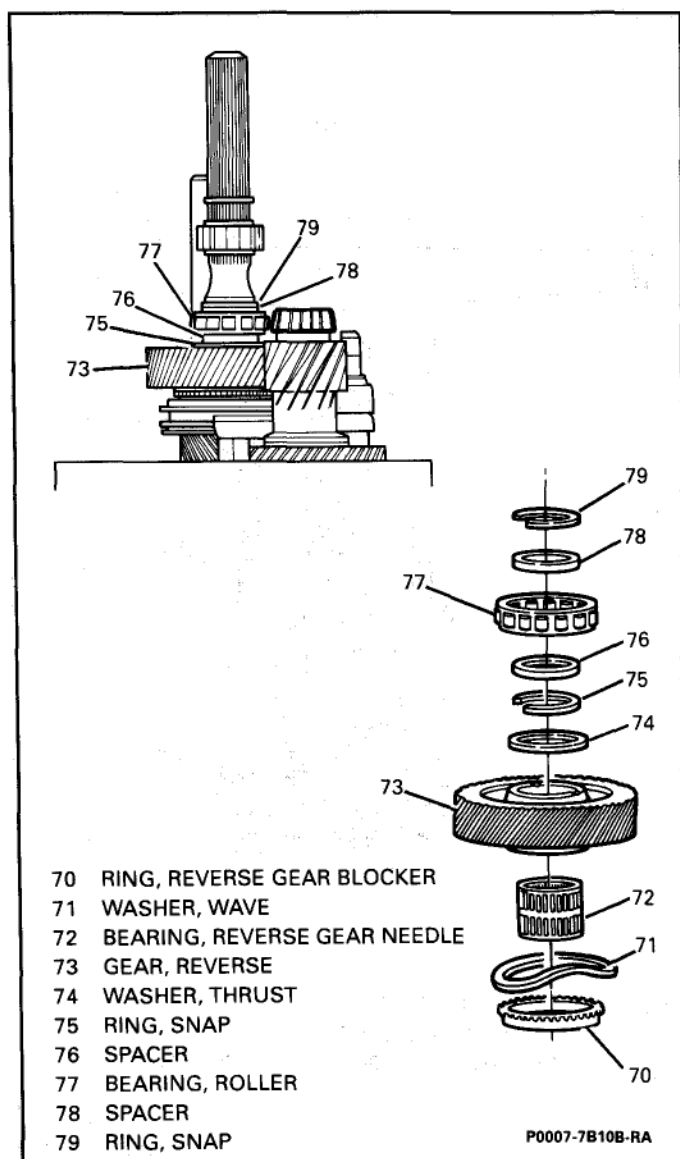


Figure 7 Reverse Speed Gear

REVERSE SHIFT FORK

Figure 8

Remove or Disconnect

- Reverse synchronizer snap ring (69).
- Reverse shift fork snap ring (113) and discard.
- Reverse shift fork (111), synchronizer (62) and thrust washer (68) at the same time.

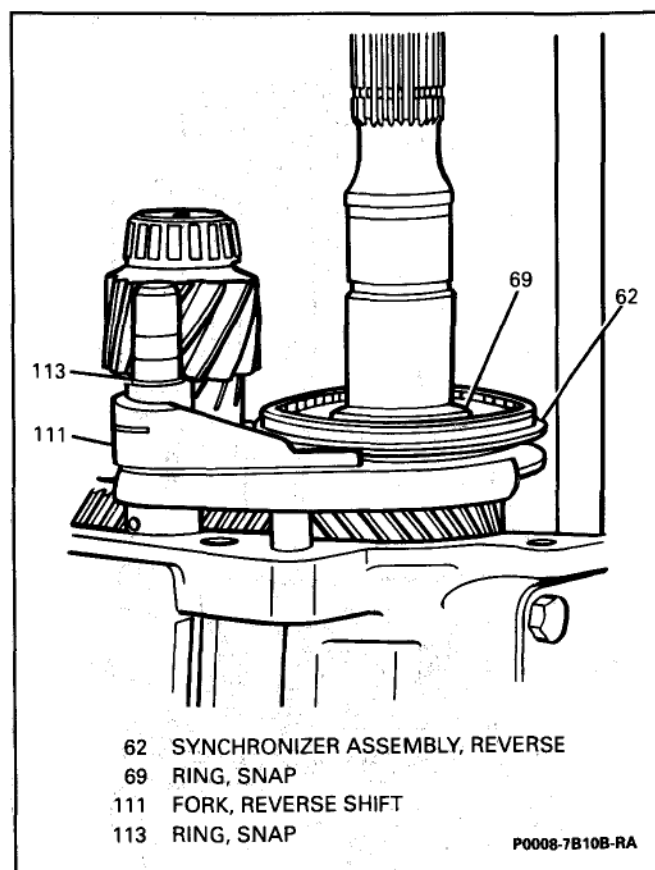


Figure 8 Reverse Shift Fork

5th/6th DRIVEN GEAR

Figure 9

Tools Required:

- J 8433 Universal Bridge Puller
- J 39431 Gear Remover
- J 39431-2 Gear Remover Bolts

Remove or Disconnect

- 5th/6th driven gear (61) using J 8433, J 39431 and J 39431-2.
 - Set J 8433 onto nose of main shaft (23).
 - Slide J 39431 under 5th/6th driven gear.
 - Install bolts J 39431-2 to J 39431.
 - 5th/6th driven gear (61) using J 8433, J 39431 and J 39431-2.

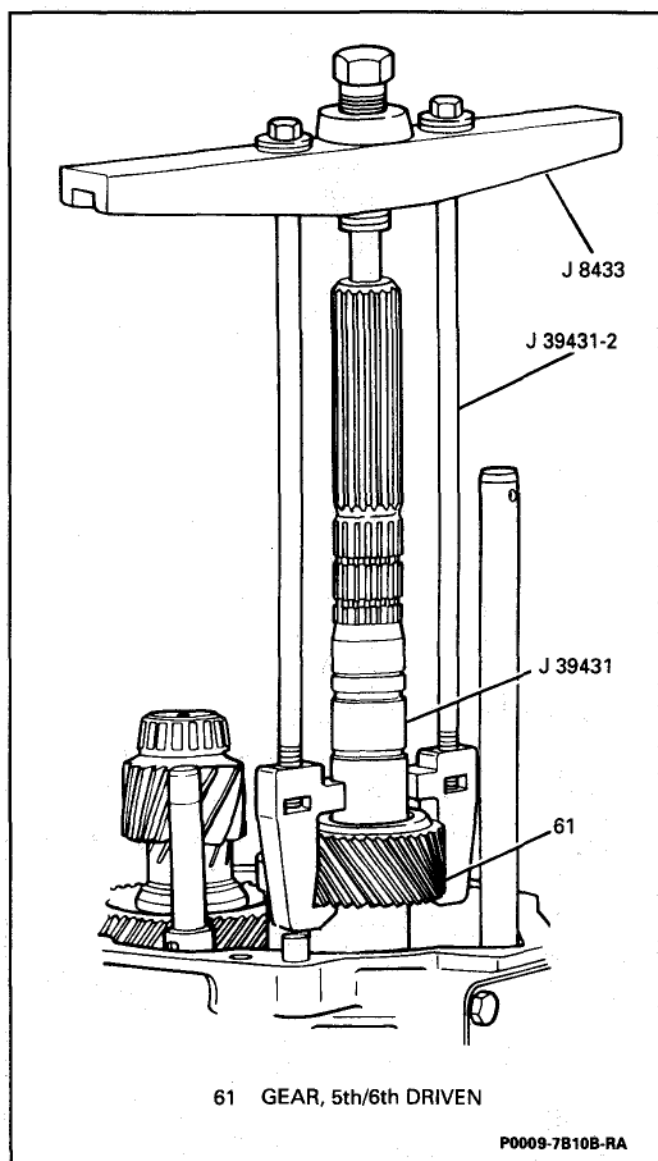


Figure 9 5th/6th Driven Gear

COUNTERSHAFT EXTENSION ASSEMBLY

Figure 10

Remove or Disconnect

1. 5th/6th shift fork snap ring (124).
2. Rotate transmission in horizontal position, guide plate up.
3. Countershaft extension assembly with 5th/6th shift fork (122).

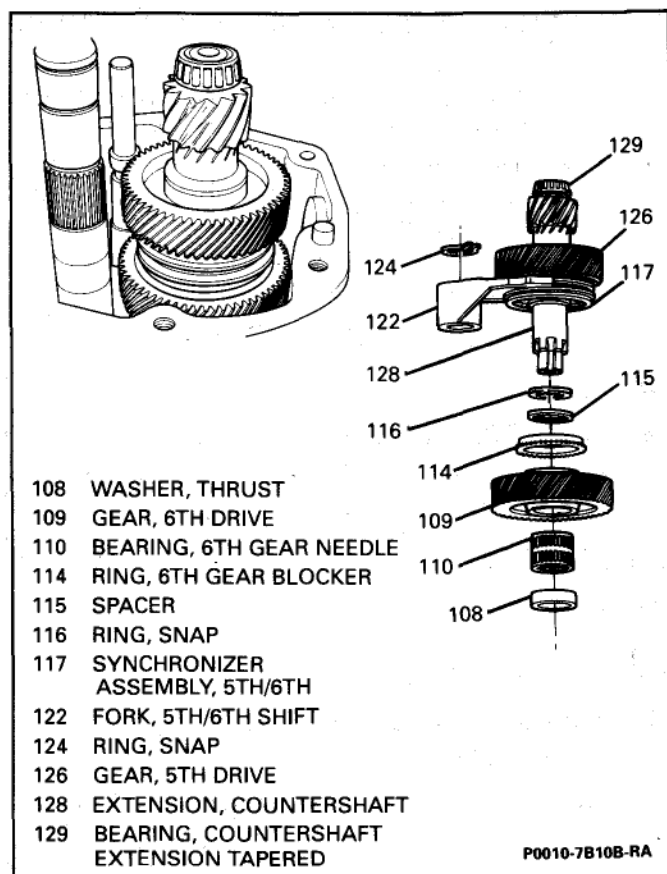


Figure 10 Countershaft Extension Assembly

TRANSMISSION CASE

Figures 11 and 12

Remove or Disconnect

1. Computer aided gear select solenoid (181).
2. Cover plate bolts (47).
3. Cover plate (48).
4. Shift detent assembly (56).
5. Roll pin (182).
6. Front offset lever rollpin (50).
7. 8 of the 10 adapter plate to transmission case bolts (178).
8. Rotate transmission into vertical position.
9. Last 2 adapter plate to transmission case bolts (178).
10. Shift lever guide bolts (45 and 46).
11. Magnets (57).

12. Transmission case (44) and front offset lever (51).

- Slide transmission case (44) up off of gear clusters and shift rail components.
- Hold offset lever (51) against guideplate (55) to prevent release of detent ball (53) and spring (52).
- Note that the loose detent ball (53) and spring (52) will come out.
- Remove solenoid lever (183).



Clean

- Shift lever guide bolt threads (45 and 46).
- Case (44) and magnets (57) with solvent and dry with compressed air.

GUIDE PLATE

Figure 11



Remove or Disconnect

1. Shift guide plate bolts (54).
2. Guide plate (55).

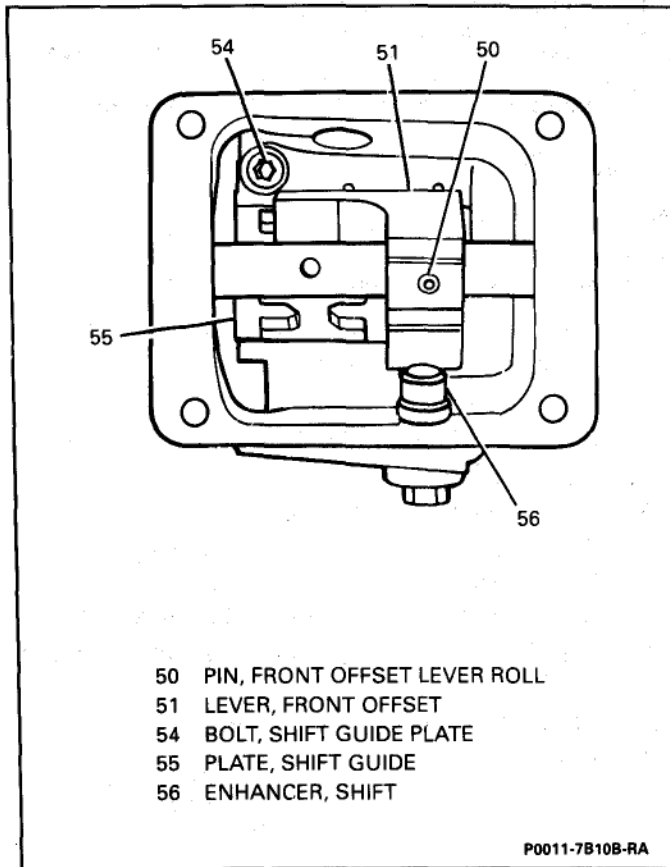


Figure 11 Shift Detent Assembly

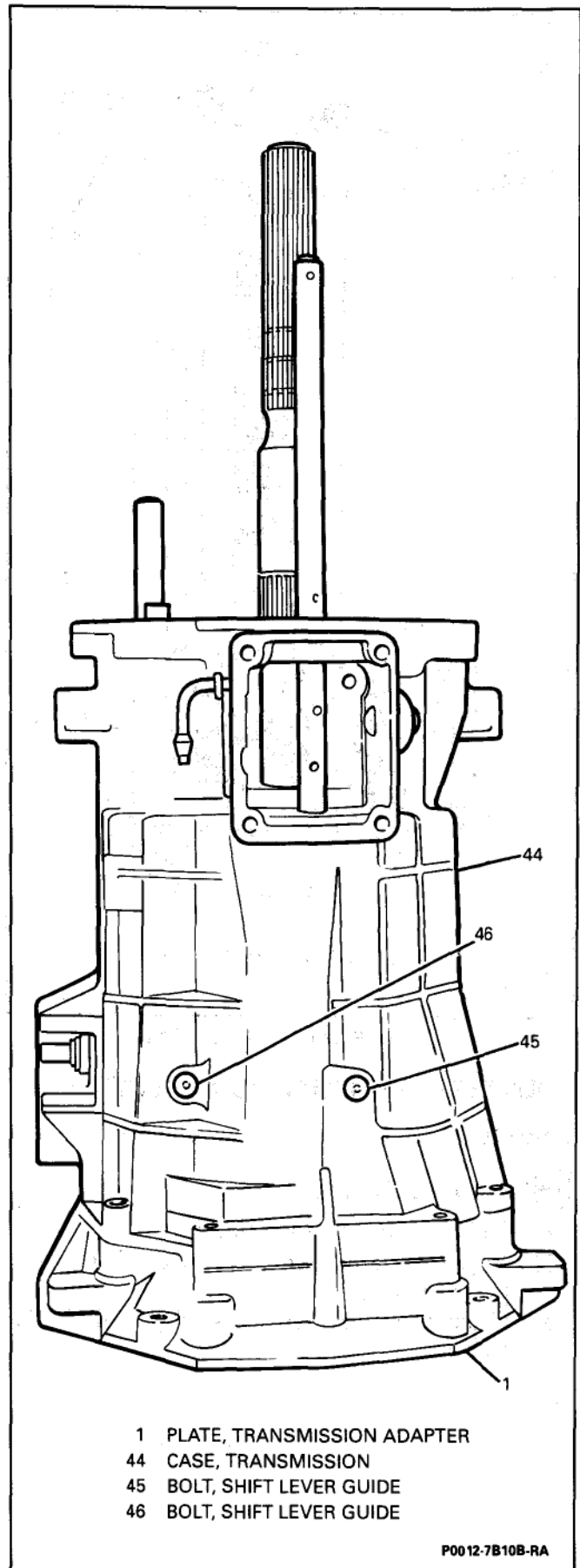


Figure 12 Transmission Case

SHIFT RAIL ASSEMBLIES AND GEAR CLUSTERS

Figure 13

Remove or Disconnect

1. Rotate 5th/6th and reverse shift rail levers (140) off shift interlock plate (156).
2. 5th/6th and reverse shift rail assembly (140).
3. Countershaft (105).
 - Lift up mainshaft (23) enough to remove countershaft (105).
4. Mainshaft (23) and shift rail assembly (149).
 - Remove components as an assembly.
5. Shift rail assembly (149) from mainshaft (23).
6. 4th gear blocker ring (12).
7. Input shaft (10).

UNIT SUBASSEMBLY REPAIR AND INSPECTION

INPUT SHAFT

Figure 14

Tools Required:

- J 5590 Press Tube
- J 22912-01 Split Plate
- J 23907 Slide Hammer
- J 28537-17 Race Installer
- J 39594 Race Remover
- Hydraulic Press

Disassemble

Important

- Do not replace tapered bearing (9) or race (11) unless inspection shows bearing or race damage.
1. Input shaft tapered bearing (9) from input shaft (10) using J 22912-01 and hydraulic press.
 2. Input shaft bearing race (11) using J 23907 and J 39594.

Clean

- Input shaft components with solvent and dry with compressed air.

Inspect

- Input shaft components.
 - Shaft (10) and spline for excessive wear or cracks. Replace if these conditions exist.
 - Gear teeth for excessive wear, pitting, scoring, spalling or fractures.
 - Bearing (9) for roughness of rotation, burred or pitted conditions. Replace if these conditions exist.

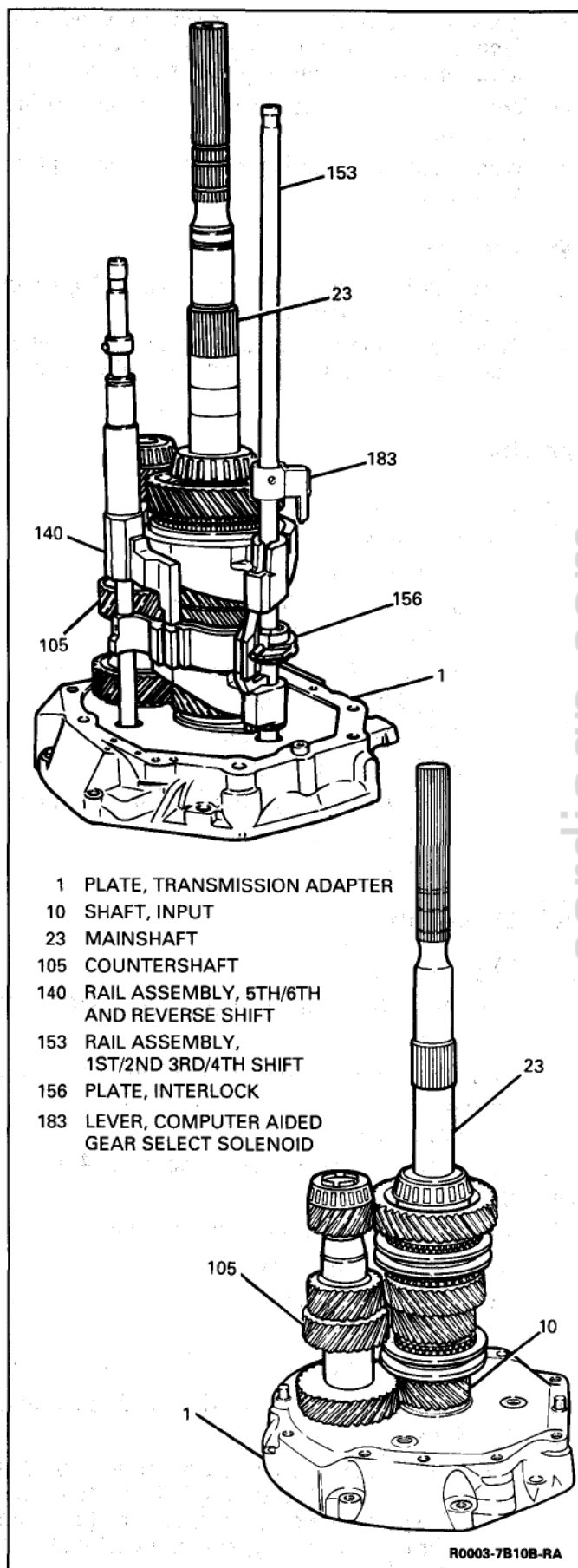


Figure 13 Shift Rail Assemblies and Gear Clusters

- If scuffed, nicked, burred or scoring conditions cannot be reconditioned by hand with a soft stone or crocus cloth, replace the component.
- When replacing bearing (9) also replace bearing race (8).
- When replacing bearing race (11) also replace bearing (22).



Assemble

1. New bearing race (11) to input shaft (10) using J 28537-17 hydraulic press.
2. New input shaft tapered bearing (9) to input shaft (10) using J 5590 and hydraulic press.

MAINSHAFT

Figure 15

Tools Required:

- J 36183 Press Tube
- J 36184 Press Tube Adapter
- J 36513 Split Plate
- J 39371 1st/2nd Synchronizer Installer
- J 39428 Split Plate
- J 39442 Press Adapter
- J 39443 Split plate
- J 39473 Bearing Installer/Press Adapter
- Hydraulic Press
- V-Blocks



Disassemble



Important

- Identify and mark blocker rings. DO NOT MIX.
1. Mainshaft large tapered bearing (42) and O-ring.
 2. 1st speed gear (41).
 3. 1st speed gear caged needle bearing (40).
 4. Snap ring (39).
 5. 1st speed gear blocker ring assembly.
 - A. Thrust washer (38).
 - B. Inner cone (37).
 - C. Friction cone (36).
 - D. Blocker ring (35).
 6. 2nd speed gear (25) using J 36513 and hydraulic press.
 - 1st/2nd synchronizer assembly (30), 2nd speed gear blocker ring (29), friction cone (28), 2nd speed gear inner cone (27), and thrust washer (26), will press off with 2nd speed gear (25).

7. 2nd speed gear caged needle bearing (24).
8. 3rd/4th synchronizer snap ring (13).
9. 3rd speed gear (20) using J 39473, V-blocks and hydraulic press.
 - 3rd/4th synchronizer assembly (14) and 3rd speed gear blocker ring (19) will press off with 3rd speed gear (20).
10. Spacer (179).
11. 3rd speed gear caged needle bearing (21).



Important

- Do not replace tapered bearing (22) unless inspection shows bearing damage.
12. Mainshaft small tapered bearing (22) using J 39442, J 39443 and hydraulic press.
 - Discard small tapered bearing (22).



Clean

- Mainshaft components with solvent and dry with compressed air.



Inspect

- Mainshaft components.
 - Shaft (23) and spline for excessive wear or cracks. Replace if these conditions exist.
 - Gear teeth (20, 25 and 41) for excessive wear, pitting, scoring, spalling or fractures.
 - Bearings (22 and 42) for roughness of rotation, burred or pitted conditions. Replace if these conditions exist.
 - Synchronizers (14 and 30). Refer to "Synchronizers" in this section.
- When replacing bearings (22 or 42) also replace bearing races (11 or 43).
- If scuffed, nicked, burred or scoring conditions cannot be reconditioned by hand with a soft stone or crocus cloth, replace the component.



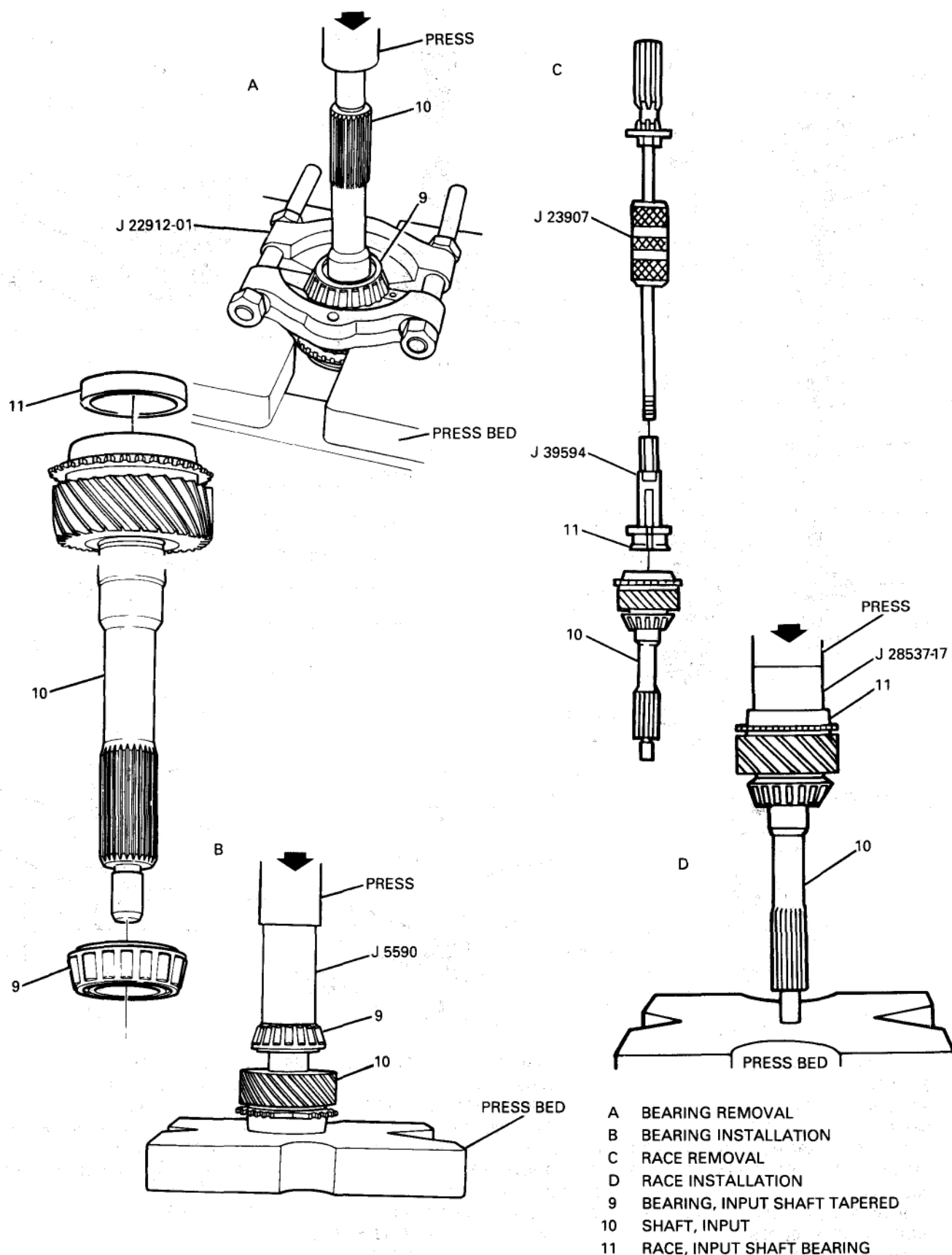
Assemble

1. New mainshaft small tapered bearing (22) using J 39473, V-blocks and hydraulic press.
2. 3rd speed gear caged needle bearing (21).
3. Spacer (179).
4. 3rd speed gear (20).
5. 3rd speed gear blocker ring (19).



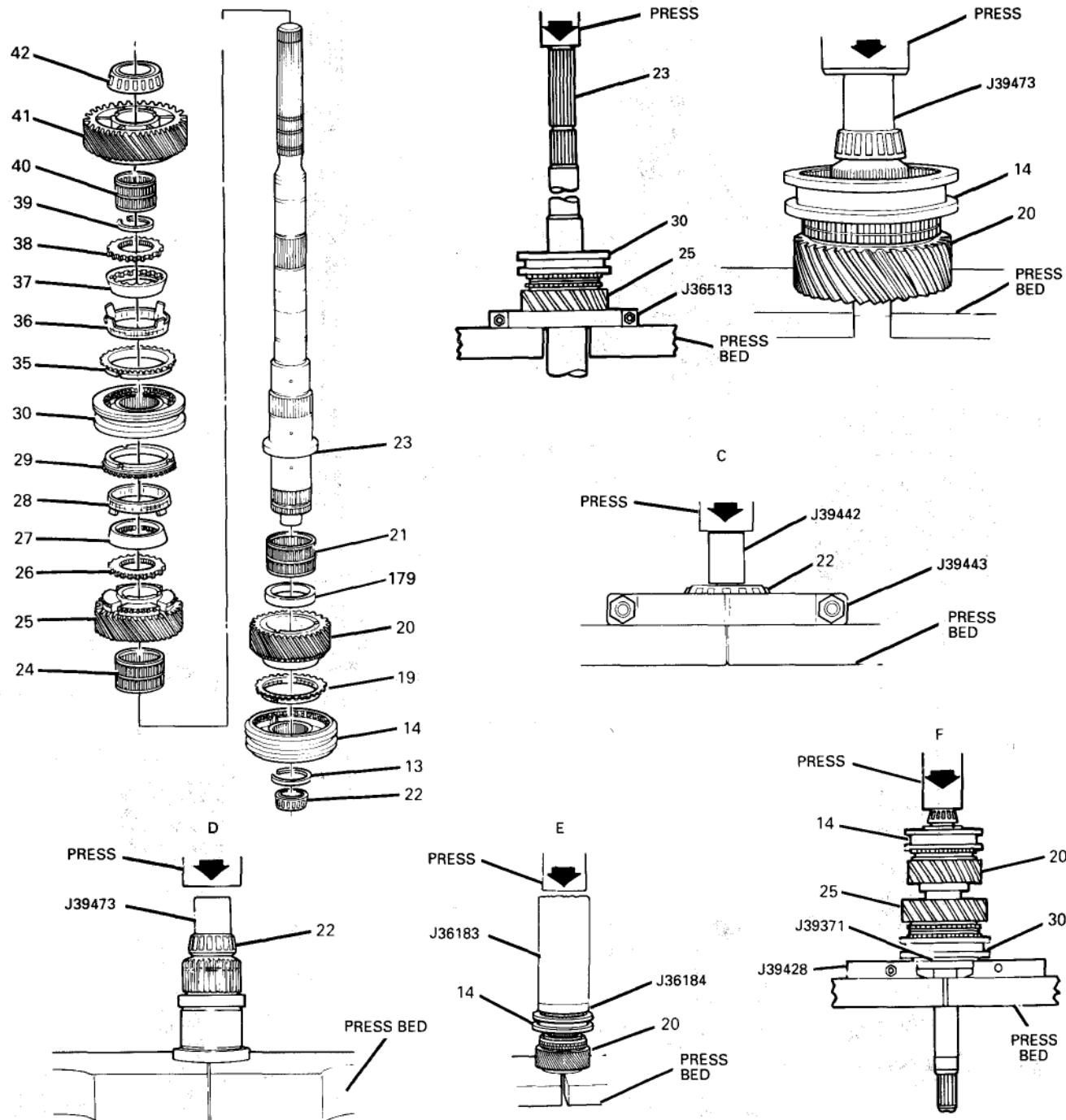
Important

- When pressing the 3rd/4th synchronizer assembly (14):
 - A. Start press operation. STOP before keys engage blocker ring slots.
 - B. Lift and rotate 3rd speed gear (20) to engage keys with blocker ring.
 - C. Continue to press until seated.



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Figure 14 Input Shaft



A 2ND GEAR REMOVAL

B 3RD GEAR REMOVAL

C BEARING REMOVAL

D BEARING INSTALLATION

E 3RD/4TH SYNCHRONIZER INSTALLATION

F 1ST/2ND SYNCHRONIZER INSTALLATION

13 RING, SNAP

14 SYNCHRONIZER ASSEMBLY, 3RD/4TH

19 RING, 3RD GEAR BLOCKER

20 GEAR, 3RD SPEED

21 BEARING, 3RD GEAR NEEDLE

22 BEARING, MAINSHAFT SMALL TAPER

23 MAINSHAFT

24 BEARING, 2ND GEAR NEEDLE

25 GEAR, 2ND SPEED

26 WASHER, THRUST

27 CONE INNER

28 CONE, FRICTION

29 RING, 2ND GEAR BLOCKER

30 SYNCHRONIZER ASSEMBLY, 1ST/2ND

35 RING, 1ST GEAR BLOCKER

36 CONE, FRICTION

37 CONE, INNER

38 WASHER, THRUST

39 RING, SNAP

40 BEARING, 1ST GEAR NEEDLE

41 GEAR, 1ST SPEED

42 BEARING, MAINSHAFT LARGE TAPERED

179 SPACER

Figure 15 Mainshaft

6. 3rd/4th synchronizer assembly (14) using J 36183, J 36184 and hydraulic press.
 - Install 3rd/4th synchronizer so ID groove on sleeve faces 3rd gear.
7. 3rd/4th synchronizer snap ring (13).
8. 2nd speed gear caged needle bearing (24).
9. 2nd speed gear (25).
10. Thrust washer (26).
11. 2nd speed gear inner cone (27).
12. Friction cone (28).
13. 2nd speed gear blocker ring (29).



Important

- When pressing the 1st/2nd synchronizer assembly (30):
 - A. Start press operation. STOP before keys engage blocker ring slots.
 - B. Lift and rotate 2nd speed gear (25) to engage keys with blocker ring.
 - C. Continue to press until seated.
14. 1st/2nd synchronizer assembly (30) using J 39371, J 39428 and hydraulic press.
 - Install 1st/2nd synchronizer so ID groove on sleeve faces 1st gear.
 15. 1st speed gear blocker ring assembly.
 - A. Blocker ring (35).
 - B. Friction cone (36).
 - C. Inner cone (37).
 - D. Thrust washer (38).
 16. Snap ring (39).
 17. 1st speed gear caged needle bearing (40).
 18. 1st speed gear (41).
 19. Mainshaft large tapered bearing (42) and O-ring.

COUNTERSHAFT

Figure 16

Tools Required:

J 5590 Press Tube
 J 22912-01 Split Plate
 J 39438 Large Countershaft Bearing Installer
 J 39473 Press Adapter
 J 39511 Split Plate
 J 39547 Press Adapter
 Hydraulic Press
 V-Blocks



Disassemble



Important

- Do not replace tapered bearings (104 and 106) unless inspection shows bearing damage.

1. Small tapered bearing (104) using J 22912-01, J 39473 and hydraulic press.
 - Discard tapered bearing (104).
2. Large tapered bearing (106) using J 39511, J 39547 and hydraulic press.
 - Discard tapered bearing (106).



Clean

- Countershaft with solvent and dry with compressed air.



Inspect

- Countershaft components.
 - Shaft (105) for excessive wear or cracks. Replace if these conditions exist.
 - Gear teeth for excessive wear, pitting, scoring, spalling or fractures.
 - Bearings (104 and 106) for roughness of rotation, burred or pitted conditions. Replace if these conditions exist.
- When replacing bearings (104 or 106) also replace bearing races (103 or 107).
- If scuffed, nicked, burred or scoring conditions cannot be reconditioned by hand with a soft stone or crocus cloth, replace the component.



Assemble

1. New large tapered bearing (106) using J 39438 and hydraulic press.
2. New small tapered bearing (104) using J 5590 and hydraulic press.

COUNTERSHAFT EXTENSION ASSEMBLY

Figure 17

Tools Required:

J 5590 Press Tube
 J 36513 Split Plate
 J 39442 Press Adapter
 J 39443 Split Plate
 J 39473 Bearing Installer
 Hydraulic Press
 V-Blocks



Disassemble

1. 5th/6th shift fork (122).
2. Thrust washer (108).
3. 6th drive gear (109).
4. Caged needle bearing (110).
5. Spacer (115).
6. 6th drive gear blocker ring (114).

7. 5th/6th synchronizer snap ring (116) and discard.
8. 5th drive gear (126) using J 36513 and hydraulic press.
 - 5th/6th synchronizer assembly (117) and 5th drive gear blocker ring (125) will press off with 5th drive gear (126).
9. 5th drive gear caged needle bearing (127).

! Important

- Do not replace small tapered bearing (129) unless inspection shows bearing damage.
10. Small tapered bearing (129) using J 39442, J 39443 and hydraulic press.



Clean

- Countershaft extension components with solvent and dry with compressed air.



Inspect

- Countershaft extension components.
 - Shaft (128) and spline for excessive wear or cracks. Replace if these conditions exist.
 - Gear teeth (109 and 126) for excessive wear, pitting, scoring, spalling or fractures.
 - Bearing (129) for roughness of rotation, burred or pitted conditions. Replace if these conditions exist.
 - Synchronizer (117). Refer to "Synchronizers" in this section.
- When replacing bearing (129) also replace bearing race (130).
- If scuffed, nicked, burred or scoring conditions cannot be reconditioned by hand with a soft stone or crocus cloth, replace the component.

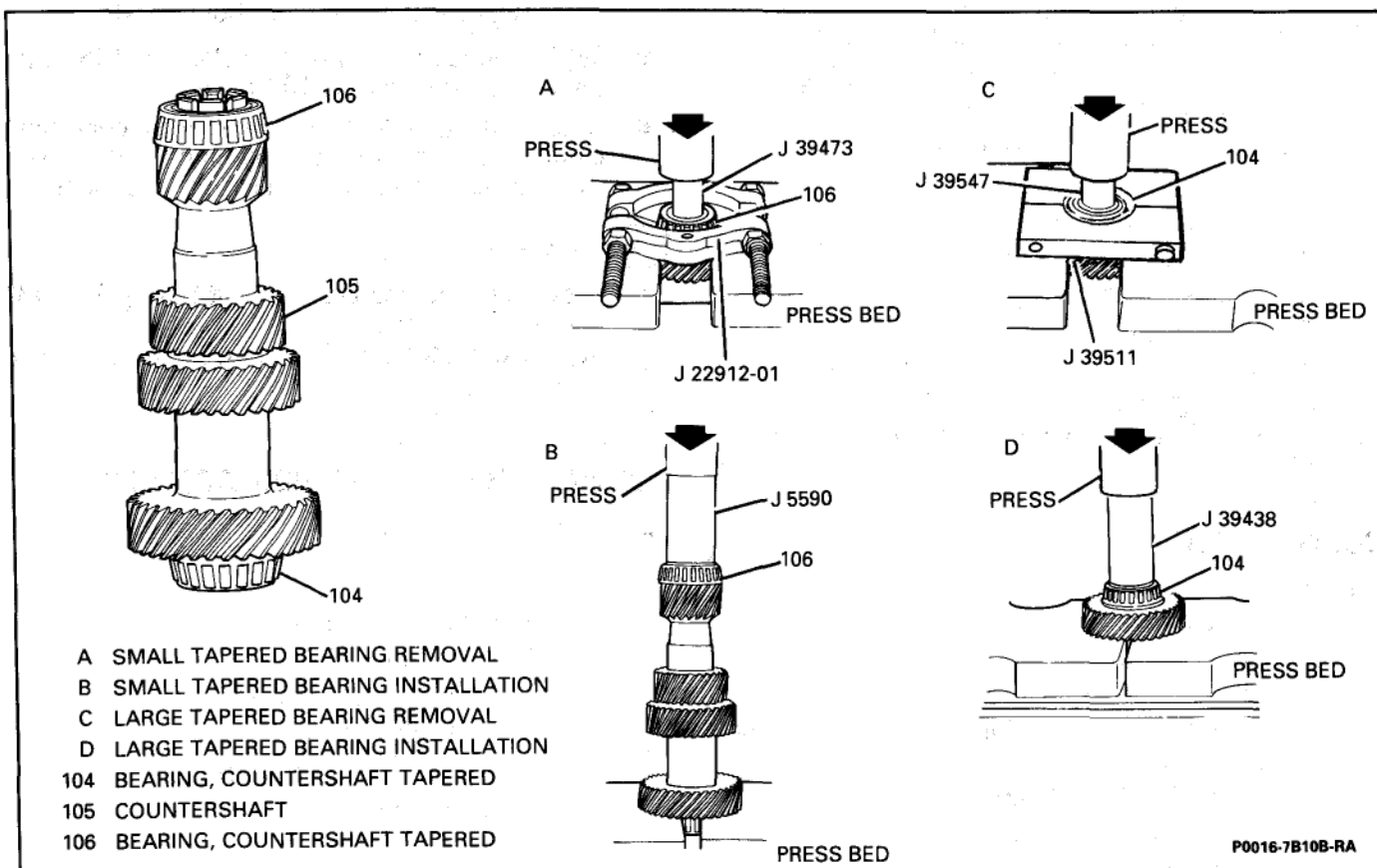
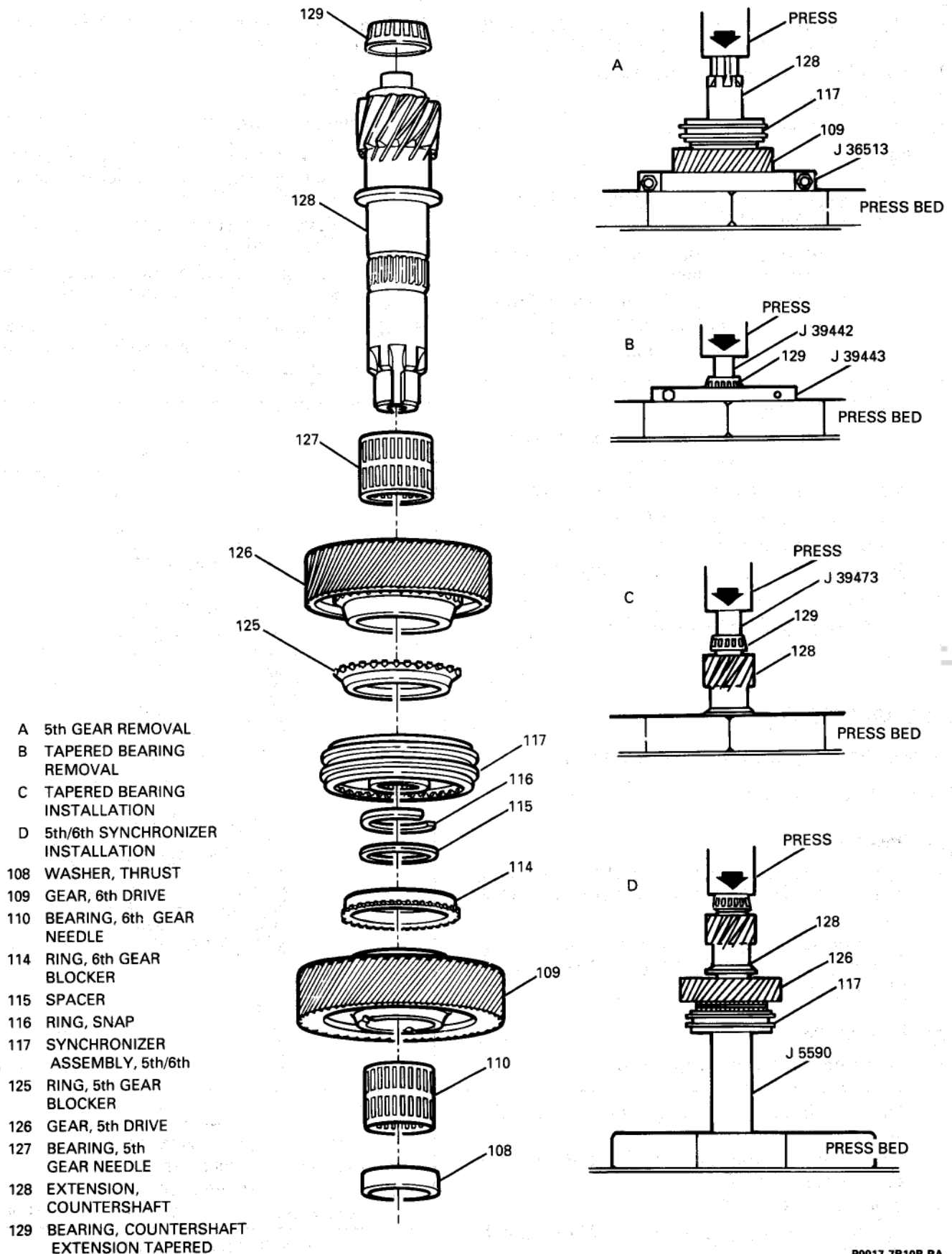


Figure 16 Countershaft



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Figure 17 Countershaft Extension

Assemble

1. New small tapered bearing (129) using J 39473, V-blocks and hydraulic press.
2. 5th drive gear caged needle bearing (127).
3. 5th drive gear (126).
4. 5th drive gear blocker ring (125).

Important

- When pressing the 5th/6th synchronizer assembly (117):
 - A. Start press operation. STOP before keys engage blocker ring slots.
 - B. Lift and rotate 5th drive gear (126) to engage keys with blocker ring.
 - C. Continue to press until seated.
- 5. 5th/6th synchronizer assembly (117) using J 5590 and hydraulic press.
 - Install 5th/6th synchronizer so ID groove on sleeve faces 5th gear.
- 6. New 5th/6th synchronizer snap ring (116).
- 7. 6th drive gear blocker ring (114).
- 8. 6th drive gear spacer (115).
- 9. 6th drive gear caged needle bearing (110).
- 10. 6th drive gear (109).
- 11. 6th drive gear thrust washer (108).
- 12. 5th/6th shift fork (122).

SYNCHRONIZERS

1st/2nd, 3rd/4th, 5th/6th Synchronizers

Figures 18, 19, 20 and 22

Important

- Synchronizer components are not interchangeable. Keep synchronizer components separate.
- Synchronizer hubs and sleeves are a selected assembly and should be kept together as originally assembled.

Disassemble

1. Synchronizer spring (15), (31), (118) using a small-bladed screwdriver.
2. Turn synchronizer assembly (14), (30), (117) over.
3. Synchronizer spring (15), (31), (118) using a small-bladed screwdriver.
4. Keys (16), (32), (119).
5. Synchronizer sleeve (18), (34), (121) from hub (17), (33), (120).

Clean

- Synchronizer components with solvent and dry with compressed air.

Inspect

- Synchronizer components.
 - Teeth for wear, nicked, burred or broken teeth. Replace hub and sleeve if excessive wear exists.
 - Keys for wear or distortion. Replace if these conditions exist.
 - Springs for distortion, cracks or wear. Replace if these conditions exist.
- If scuffed, nicked or burred conditions cannot be corrected by hand with a soft stone or crocus cloth, replace the component.

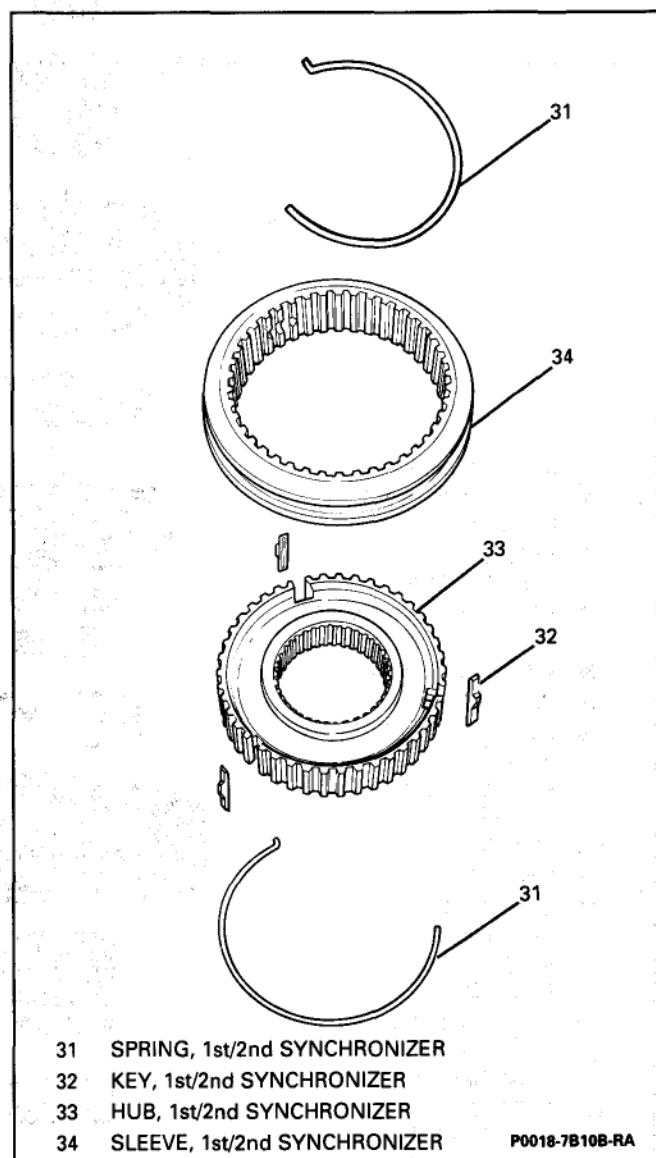


Figure 18 1st/2nd Synchronizer

**Assemble**

1. Synchronizer sleeve (18), (34), (121) to hub (17), (33), (120).
 - Align key openings in hub (17), (33), (120) with cuts in synchronizer sleeve (18), (34), (121).
2. Keys (16), (32), (119) with slots facing hub (17), (33), (120).
3. Synchronizer spring (15), (31), (118) using a small-bladed screwdriver.
 - Locate spring tang to one of the key slots.
4. Turn synchronizer assembly (14), (30), (117) over.
5. Synchronizer spring (15), (31), (118) using a small-bladed screwdriver.
 - Locate spring tang on same key but wind in opposite direction.

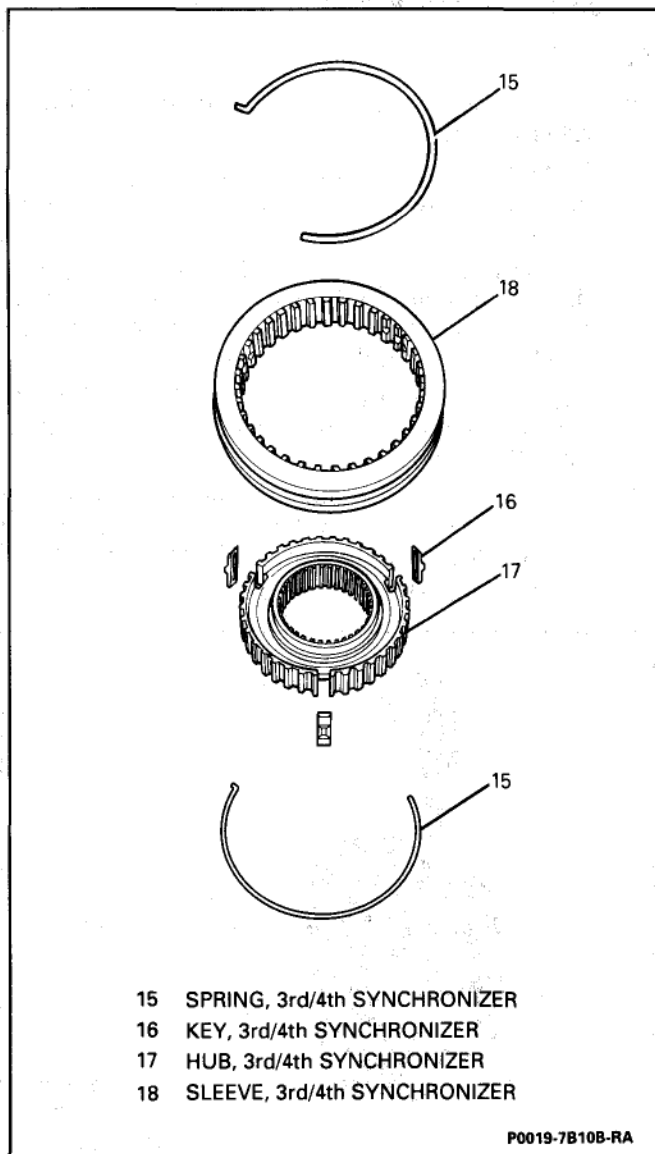


Figure 19 3rd/4th Synchronizer

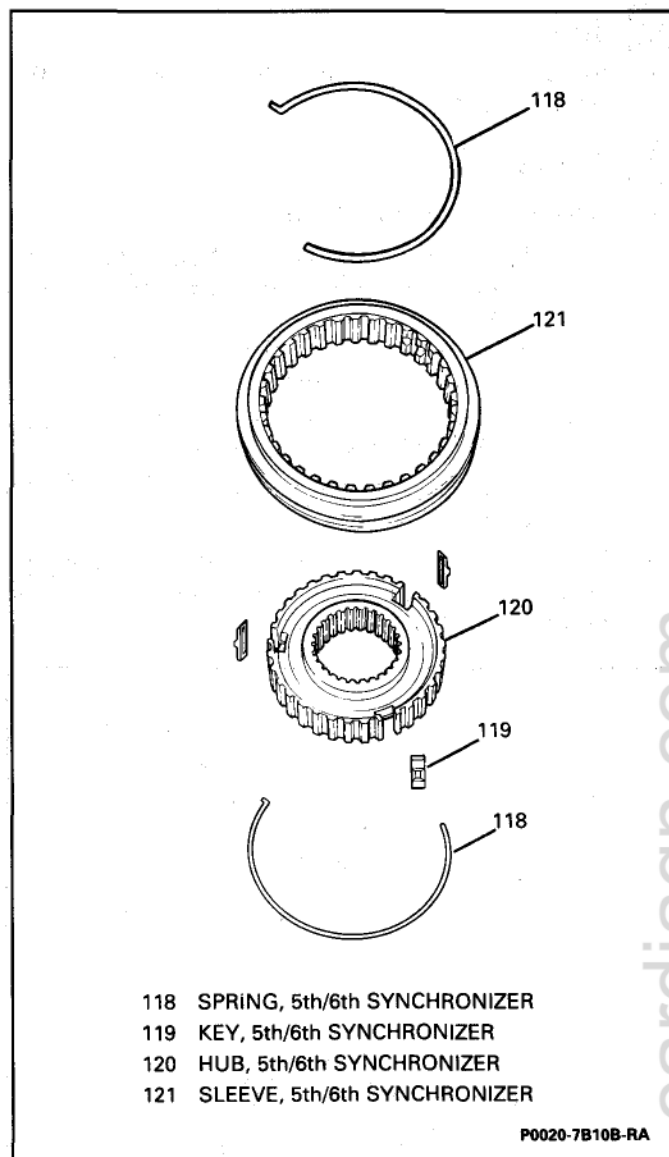


Figure 20 5th/6th Synchronizer

Reverse Synchronizer

Figure 21

**Disassemble**

1. Synchronizer spring (63) using a small-bladed screwdriver.
2. Synchronizer sleeve (66) from hub (65) by pressing against inner hub (65).
3. Turn hub (65) over.
 - Keys (64) will slide out from hub (65).
4. Synchronizer key retainer (67) using a small-bladed screwdriver through key slots of hub (65) and discard retainer (67).
5. Synchronizer spring (63) using a small-bladed screwdriver.

**Clean**

- Synchronizer components with solvent and dry with compressed air.

**Inspect**

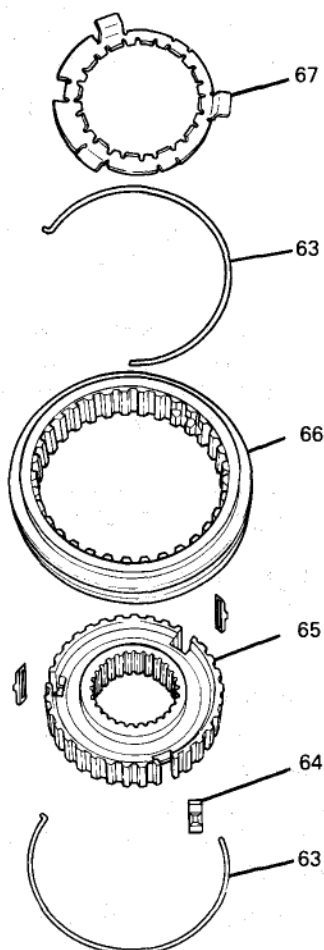
- Synchronizer components.
 - Teeth for wear, nicked, burred or broken teeth. Replace hub and sleeve if excessive wear exists.
 - Keys for wear or distortion. Replace if these conditions exist.
 - Springs for distortion, cracks or wear. Replace if these conditions exist.
 - Retainer for distortion. Replace if this condition exists.
- If scuffed, nicked or burred conditions cannot be corrected by hand with a soft stone or crocus cloth, replace the component.

**Assemble**

1. Synchronizer sleeve (66) to hub (65).
 - Align key openings in hub (65) with cuts in synchronizer sleeve (66).
2. Keys (64) with slots facing hub (65).
3. Synchronizer spring (63) using a small-bladed screwdriver.
 - Locate spring tang to one of the key slots.
4. Turn synchronizer assembly (62) over.
5. Synchronizer spring (63) using a small-bladed screwdriver.
 - Locate spring tang on same key but wind in opposite direction.
6. New synchronizer key retainer (67).
 - Locate key retainer tangs over synchronizer keys (64).

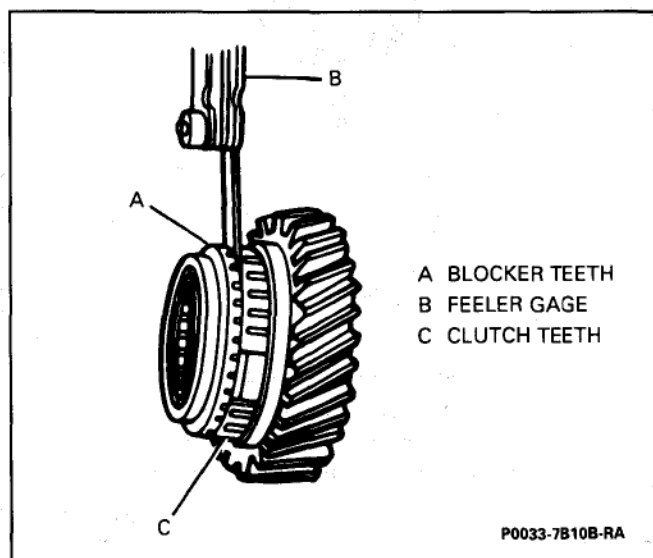
Synchronizer Blocker Ring Inspection**Figure 22**

- Inspect the gear cones, clutch teeth and blocker rings for excessive wear.
- Inspect the synchronizer sleeve and gear clutch teeth for evidence of gear clash or cause of hop-out.
- Measure the gap between the blocker ring and the speed gear. Make sure the correct blocker ring is measured with the correct gear and the blocker ring is fully seated on the gear.
- Replace blocker rings for 1st, 2nd, 3rd, 4th, 5th and 6th gears if the wear gap is less than 0.38 mm (0.015 in.).
- Replace the reverse blocker ring if the wear gap is less than 0.75 mm (0.030 in.), when measured without the wave washer (71) in between the blocker ring and reverse gear.



- 63 SPRING, REVERSE SYNCHRONIZER
 64 KEY, REVERSE SYNCHRONIZER
 65 HUB, REVERSE SYNCHRONIZER
 66 SLEEVE, REVERSE SYNCHRONIZER
 67 RETAINER, REVERSE SYNCHRONIZER KEY

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Figure 21 Reverse Synchronizer

- A BLOCKER TEETH
 B FEELER GAGE
 C CLUTCH TEETH

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Figure 22 Measuring Blocker Ring Wear

SHIFT RAIL AND FORK ASSEMBLIES**1st/2nd, 3rd/4th Shift Rail Assembly****Figure 23** **Disassemble**

1. Rotate selector pin (155) until opposite shift links (152 and 157).
2. 3rd/4th shift fork (158) with shift link (157) from rail (153).
3. 1st/2nd shift fork (150) with shift link (152) from rail (153).
4. Roll pin (182) and computer aided gear select solenoid lever (183) from rail (153).
5. Interlock plate (156) from rail (153).
6. Selector pin roll pin (154).
7. Selector pin (155).

 Clean

- Shift rail and fork assembly components with solvent and dry with compressed air.

 Inspect

- Shift rail and fork assembly components.
 - Rail (153) for excessive wear or burrs. Replace if these conditions exist.
 - Shift forks (150 and 158) for excessive wear, fracture or distortion. Replace if these conditions exist.
 - Shift links (152 and 157) for excessive wear, fracture or distortion. Replace if these conditions exist.
 - Shift fork nylon inserts (151 and 159) for excessive wear. Replace if this condition exists.

 Assemble

1. Selector pin (155).
2. Selector pin roll pin (154).
3. Interlock plate (156) to rail (153).
4. 1st/2nd shift fork (150) with shift link (152) to rail (153).
5. Computer aided gear select solenoid lever (183) to rail (153).
6. Roll pin (182) to lever (183).
7. 3rd/4th shift fork (158) with shift link (157) to rail (153).
8. Align selector pin (155) with slots in shift links (152 and 157).

5th/6th, Reverse Shift Rail Assembly**Figure 23****Tool Required:**

- J 23907 Slide Hammer
- J 36800 Bushing Remover
- J 39437 Bushing Installer

 Disassemble

1. Collar roll pin (141).
2. Collar (142).
3. 5th/6th shift rail lever (144) from rail (143).

 Important

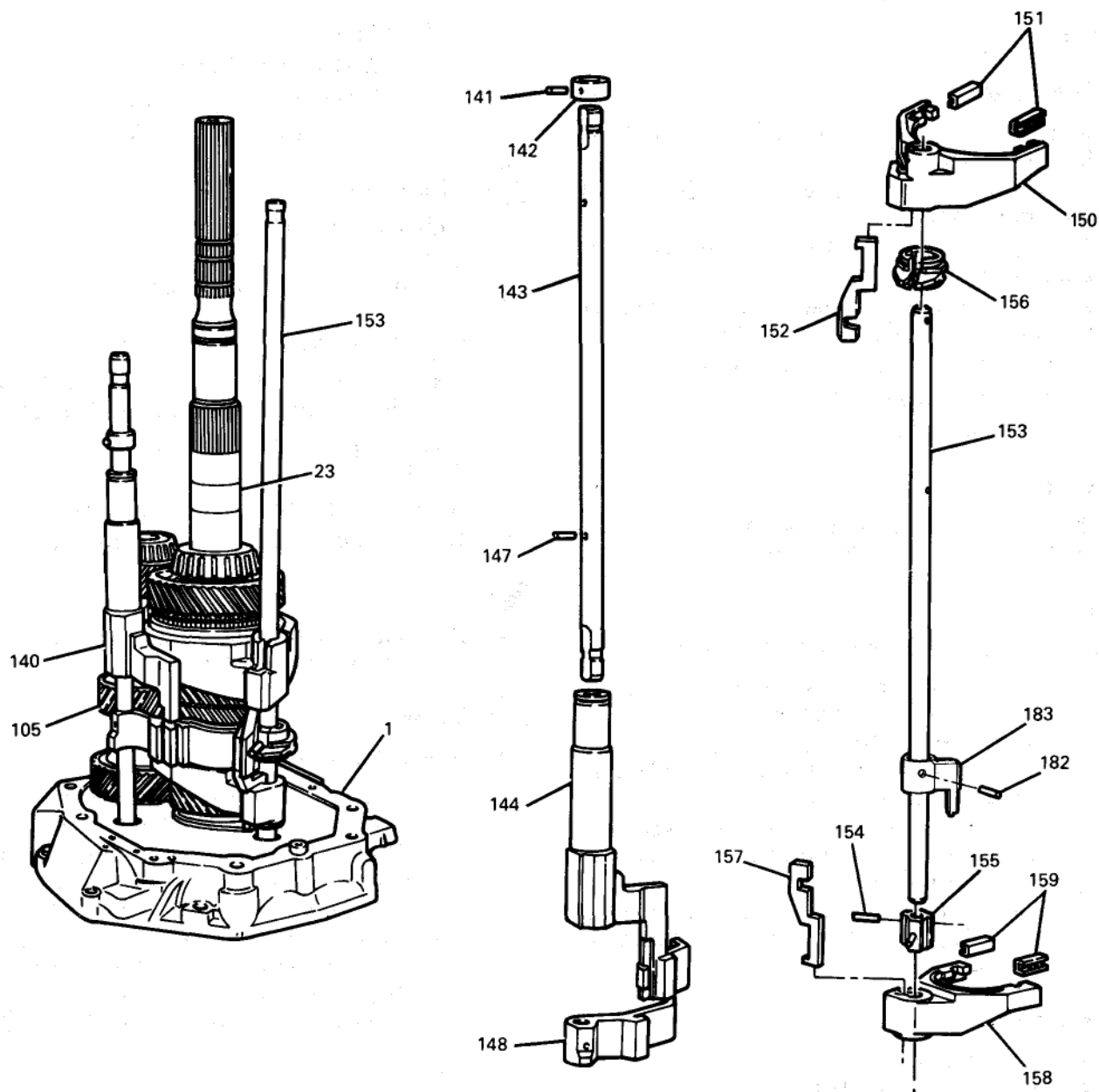
- Do not replace bushings (146) unless inspection shows bushing damage.
4. 5th/6th shift rail lever bushings (146) using J 23907 and J 36800.
 5. Reverse shift rail lever roll pin (147).
 6. Reverse shift rail lever (148) from rail (143).

 Clean

- Shift rail assembly components with solvent and dry with compressed air.

 Inspect

- Shift rail assembly components.
 - Rail (143) for excessive wear or burrs. Replace if these conditions exist.
 - Shift rail levers (144 and 148) for excessive wear, fracture or distortion. Replace if these conditions exist.
 - Shift rail lever nylon insert for excessive wear. Replace if this condition exists.
 - Shift rail lever bushings (146) for excessive wear. Replace if this condition exists.



- 1 PLATE, TRANSMISSION ADAPTER
- 23 MAINSHAFT
- 105 COUNTERSHAFT
- 140 RAIL ASSEMBLY, 5TH/6TH AND REVERSE SHIFT
- 141 PIN, ROLL
- 142 COLLAR
- 143 RAIL, SHIFT
- 144 LEVER, 5TH/6TH SHIFT RAIL
- 147 PIN, ROLL
- 148 LEVER, REVERSE SHIFT RAIL
- 150 FORK, 1ST/2ND SHIFT

- 151 PAD, 1ST/2ND SHIFT FORK
- 152 LINK, SHIFT
- 153 RAIL ASSEMBLY, 1ST/2ND 3RD/4TH SHIFT
- 154 PIN, ROLL
- 155 PIN, SELECTOR
- 156 PLATE, INTERLOCK
- 157 LINK, SHIFT
- 158 FORK, 3RD/4TH SHIFT
- 159 PAD, 3RD/4TH SHIFT FORK
- 182 PIN, ROLL
- 183 LEVER, COMPUTER AIDED GEAR SELECT SOLENOID

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Figure 23 Shift Rail and Fork Assemblies



Assemble

1. Reverse shift rail lever (148) to rail (143).
 - Locate reverse shift rail lever (148) to roll pin hole at opposite end of rail (143) from snap ring groove.
 - Notched edge of reverse shift rail lever should face towards other roll pin hole.
2. Reverse shift rail lever roll pin (147).
3. 5th/6th shift rail lever bushings (146) using J 39437.
4. 5th/6th shift rail lever (144) to rail (143).
5. Collar (142).
6. Collar roll pin (141).

TRANSMISSION ADAPTER PLATE

Figure 24

Tools Required:

- J 23907 Slide Hammer
- J 36800 Bushing Remover
- J 39433 Input Shaft Seal Installer
- J 39437 Bushing Installer



Disassemble

1. Input shaft bearing race (8) and shim (7).
2. Countershaft bearing race (103) and shim (102).
3. Adapter plate plug (2).
4. Input shaft seal (6).



Important

- Do not replace bushing (5) unless inspection shows bushing damage.
5. 1st/2nd, 3rd/4th shift rail bushing (5) using J 23907 and J 36800.
 6. Dowel pins (3 and 4).



Clean

- Adapter plate components with solvent and dry with compressed air.



Inspect

- Adapter plate components.
 - Bearing races (8 and 103) and bores for wear, scratches or grooves.
 - Bushing (5) for excessive wear or burrs. Replace if this condition exists.
 - Case for cracks, sealing surfaces for nicks, burrs or scratches. If case is cracked, it must be replaced.
- If scratches, grooves or nicks cannot be removed by hand with a soft stone or crocus cloth, replace the components.



Assemble

1. Dowel pins (3 and 4).
2. 1st/2nd, 3rd/4th shift rail bushing (5) using J 39437.
3. Input shaft seal (6) using J 39433.



Important

- Do not install shims (102 and 7) until after performing "Shimming Procedures" later in this section.
4. Countershaft bearing race (103).
 5. Input shaft bearing race (8).

TRANSMISSION CASE

Figure 25

Tools Required

- J 8092 Drive Handle
- J 36190 Drive Handle
- J 39435 Mainshaft Bearing Race Installer
- J 39436 Countershaft Bearing Race Installer
- J 39437 Bushing Installer
- J 39439 Bushing Remover
- J 39790 Mainshaft Bearing Race Remover
- J 39791 Countershaft Bearing Race Remover



Disassemble

1. Guide plate bolts (54) and guide plate (55).
2. Fill plug (60).
3. Backup lamp switch (59).
4. Computer aided gear select solenoid (185).
5. Dowel pins (58).



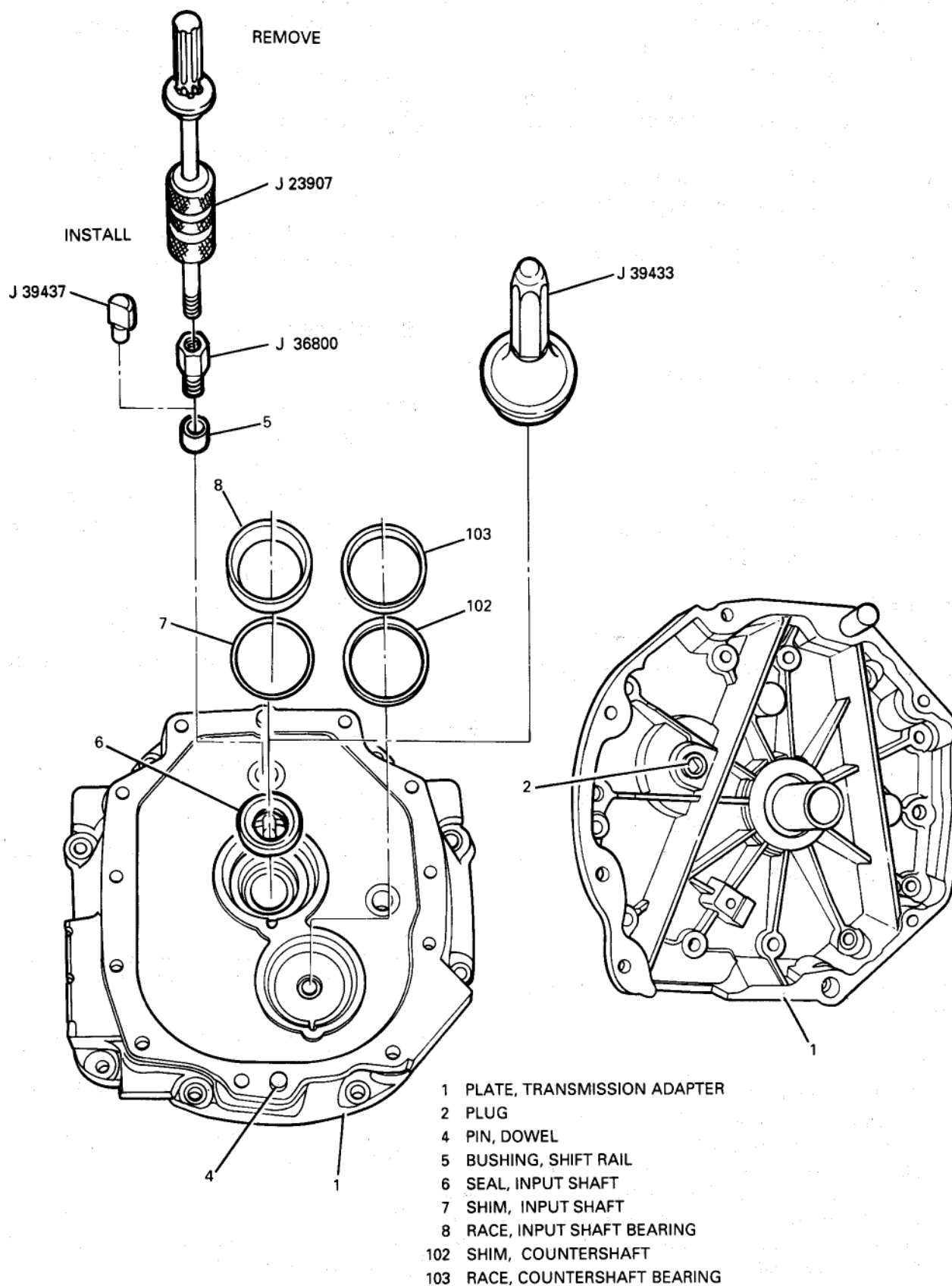
Important

- Do not replace bearing races (107 and 43) unless inspection shows bearing race damage.
6. Countershaft bearing race (107) using J 8092 and J 39791.
 7. Mainshaft bearing race (43) using J 8092 and J 39790.
 8. 1st/2nd, 3rd/4th shift rail bushing (49) using J 36190 and J 39439.



Clean

- Transmission case components with solvent and dry with compressed air.



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Figure 24 Transmission Adapter Plate

**Inspect**

- Transmission case components.
 - Bearing races (43 and 107) and bores for wear, scratches or grooves.
 - Bushing (49) for excessive wear. Replace if this condition exists.
 - Case (44) for cracks, threaded openings for damaged threads, sealing surfaces for nicks, burrs or scratches. If case is cracked, it must be replaced.
- If scratches, grooves or scoring cannot be removed by hand with a soft stone or crocus cloth, replace the component.

**Assemble**

1. 1st/2nd, 3rd/4th shift rail bushing (49) using J 39437.
2. Mainshaft bearing race (43) using J 8092 and J 39435.
3. Countershaft bearing race (107) using J 8092 and J 39436.
4. Dowel pins (58).
5. Computer aided gear select solenoid (185).
6. Backup lamp switch (59).

**Tighten**

- Switch (59) to 27 N·m (20 lb. ft.)
7. Fill plug (60) with sealant GM p/n 1052080.

**Tighten**

- Fill plug (60) to 18 N·m (13 lb. ft.).
8. Guide plate (55) and guide plate bolts (54).

**Tighten**

- Bolts (54) to 22 N·m (16 lb. ft.).

EXTENSION HOUSING**Figure 26****Tools Required:**

- J 8092 Drive Handle
- J 39439 Bushing Remover/Installer
- J 39440 Rear Boot and Seal Installer
- J 39546 Bearing Race Installer
- J 39789 Bearing Race Remover

**Disassemble**

1. Reverse idler shaft bracket bolts (133).
2. Reverse idler shaft bracket (134).
3. Reverse idler gear thrust washer (135).
4. Reverse idler gear (136).
5. Roller bearing (137).

6. Thrust washer (139).
7. Reverse idler shaft (138).
8. Countershaft extension bearing race (130).
9. Shim (131).
10. Funnel (132).
11. Plug (101).
12. Reverse lockout assembly bolt (90).

CAUTION: The reverse lockout assembly is under spring pressure. Exercise caution when removing snap ring (173), as bodily injury may result.

13. Reverse lockout assembly (91).
 - A. Reverse lockout solenoid (89) from reverse lockout body (175).
 - B. O-ring (160) from body (175).
 - C. Snap ring (169) from body (175).
 - D. Reverse lockout inner spring (174).
 - E. Compress reverse lockout plunger (170) and collar (172) in vise and remove snap ring (173).
 - F. Reverse lockout plunger (170).
 - G. Reverse lockout outer spring (171).
 - H. Reverse lockout collar (172).
14. Vehicle speed sensor bolt (88).
15. Vehicle speed sensor (87) and clamp.
 - O-ring seal from vehicle speed sensor (87).
16. Rear seal and boot (99).
 - Pry out seal and boot (99) with suitable tool.
17. Mainshaft bearing race snap ring (84).

**Important**

- Do not replace bearing race (85) unless inspection shows bearing race damage.

18. Mainshaft bearing race (85) using J 8092 and J 39789.

**Important**

- Do not replace bushing (92) unless inspection shows bushing damage.
19. Shift rail bushing (92) using J 36190 and J 39439.

**Clean**

- Extension housing components with solvent and dry with compressed air.

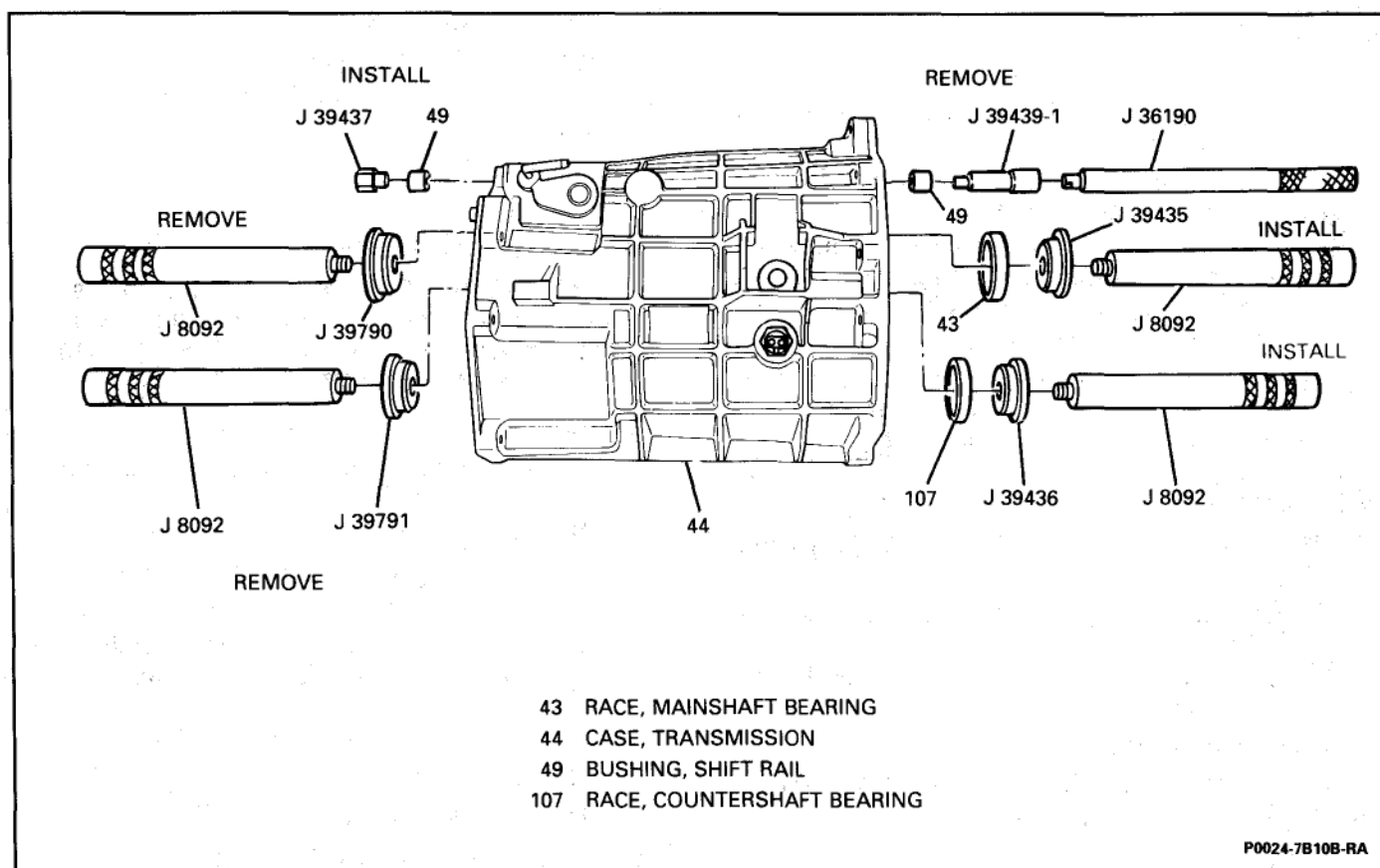


Figure 25 Transmission Case

**Inspect**

- Extension housing components.
 - Bearing races (85 and 130) and bores for wear, scratches or grooves.
 - Bushing (92) for excessive wear or burrs. Replace if this condition exists.
 - Case (86) for cracks, sealing surfaces for nicks, burrs or scratches. If case is cracked, it must be replaced.
- If scratches, grooves or nicks cannot be removed by hand with a soft stone or crocus cloth, replace the component.

**Assemble**

1. Shift rail bushing (92) using J 36190 and J 39439.
2. Mainshaft bearing race (85) using J 8092 and J 39546.
3. Mainshaft bearing race snap ring (84).
4. Rear seal and boot (99) using J 39440.
 - Locate drain hole in rear seal and boot (99) down.
5. O-ring seal to vehicle speed sensor (87).

6. Vehicle speed sensor (87) and clamp.
7. Vehicle speed sensor bolt (88).

**Tighten**

- Bolt (88) to 10 N·m (84 lb. in.)

CAUTION: The reverse lockout assembly is under spring pressure. Exercise caution when installing snap ring (173), as bodily injury may result.

8. Assemble reverse lockout body assembly.
 - A. Reverse lockout plunger (170).
 - B. Reverse lockout outer spring (171).
 - C. Reverse lockout collar (172).
 - D. Compress reverse lockout plunger (170), collar (172) and outer spring (171) in vise and install snap ring (173).
 - E. Reverse lockout inner spring (174).
 - F. Install reverse lockout components in lockout body (175) and install snap ring (169).
 - G. Reverse lockout solenoid (89) to reverse lockout body assembly (91).

**Tighten**

- Solenoid (89) to 40 N·m (30 lb. ft.).
- H. O-ring (160) to body assembly (91).

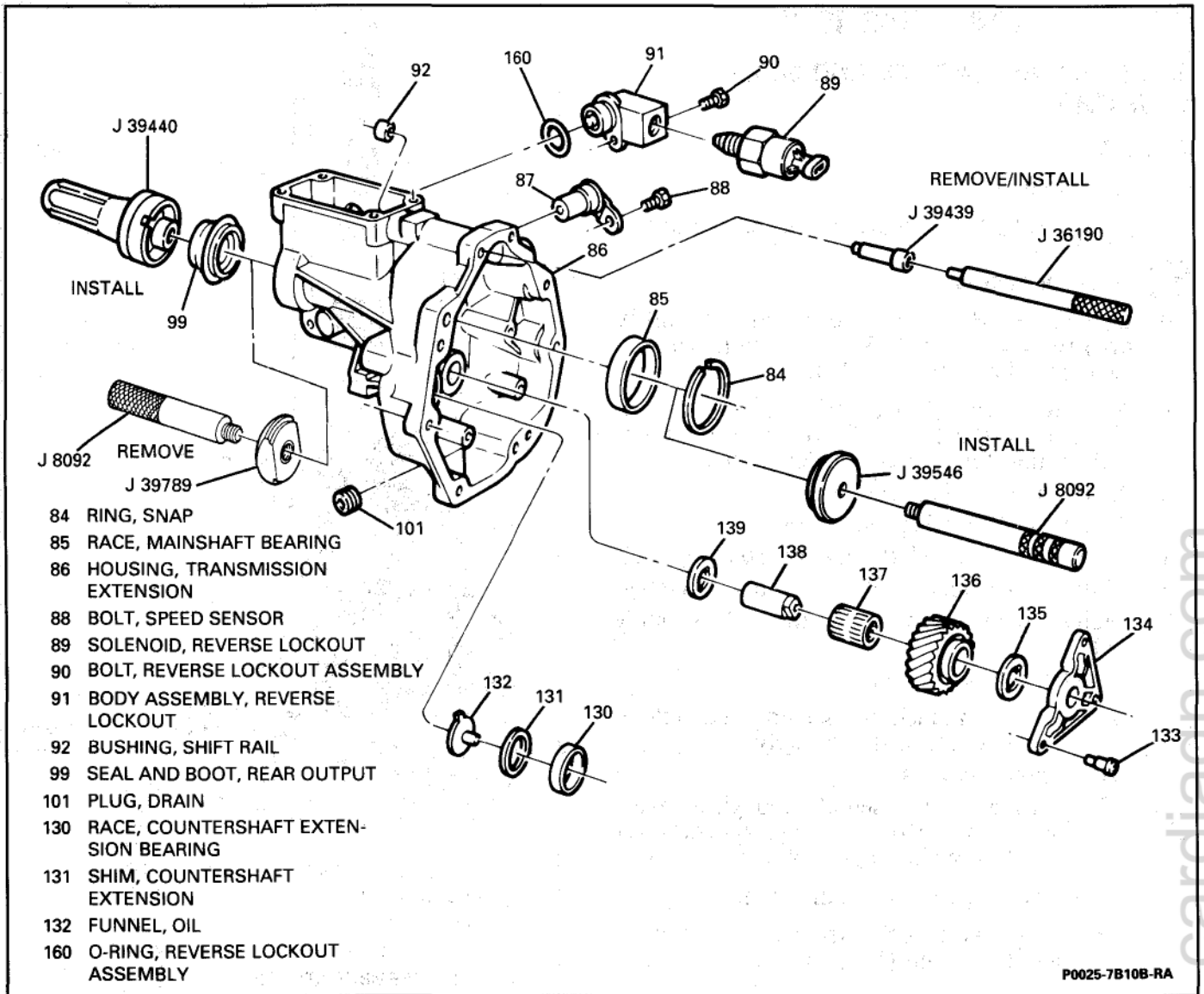


Figure 26 Transmission Extension Housing

10. Reverse lockout assembly.
11. Reverse lockout assembly bolt (90).



Tighten

- Bolt (90) to 18 N·m (13 lb. ft.).

12. Plug (101) with sealant GM p/n 1052080.



Tighten

- Plug (101) to 18 N·m (13 lb. ft.).

13. Countershaft extension bearing race (130).



Important

- Do not install shim (131) until after performing "Shimming Procedures" later in this section.

UNIT ASSEMBLY

SHIFT RAIL ASSEMBLIES AND GEAR CLUSTERS

Figure 27

Tool Required:

J 36850 Transmission Assembly Lube



Install or Connect

- Lubricate all components as assembly progresses. Use J 36850 Transmission Assembly Lube or equivalent.
- 1. Selective shims (7 and 102). Refer to "Input Shaft/Mainshaft and Countershaft" under "Shimming Procedures" in this section.
- 2. Input shaft bearing race (8).
- 3. Countershaft bearing race (103).
- 4. Input shaft (10) and 4th gear blocker ring (12).
- 5. Shift rail assembly (149) to mainshaft assembly.
- 6. Mainshaft assembly with shift rail assembly (149).
- 7. Countershaft assembly.
 - A. Lift up mainshaft assembly enough to install countershaft assembly.
 - B. Countershaft assembly.
 - C. Lift mainshaft assembly enough to rotate input shaft (10) to engage synchronizer keys (16) with 4th gear blocker ring (12).
- 8. 5th/6th and reverse shift rail (140).
 - Align slots of shift rail levers with interlock plate (156).

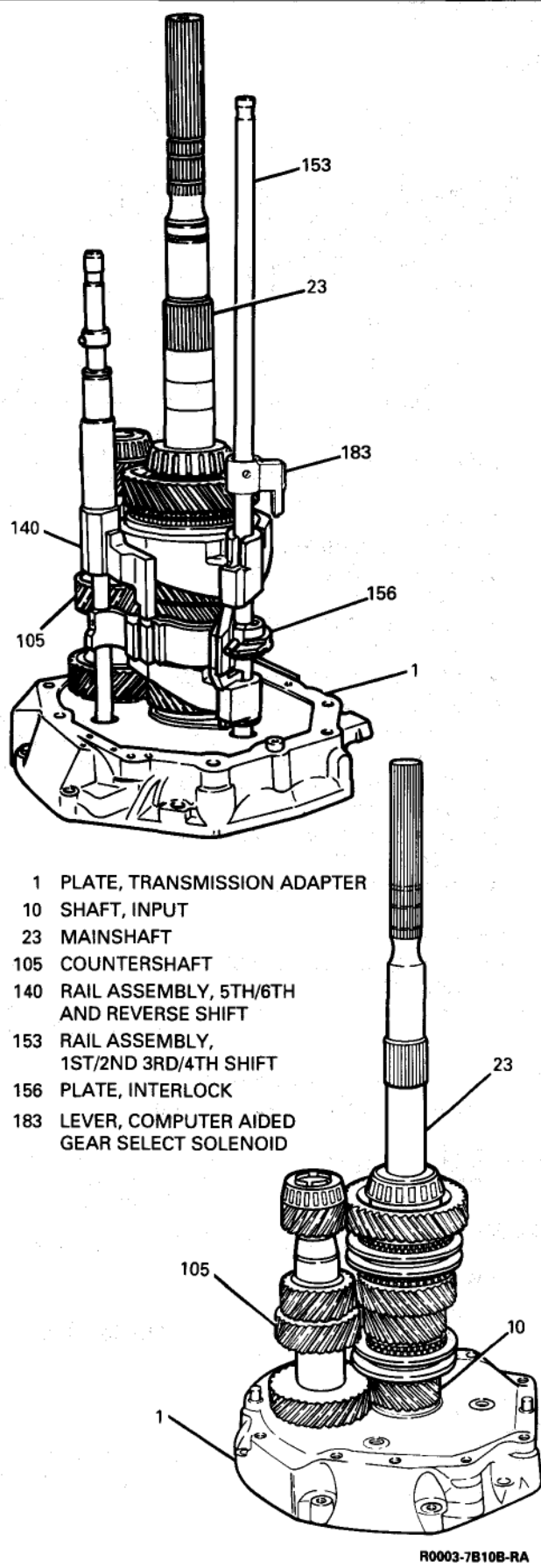


Figure 27 Shift Rail Assemblies and Gear Clusters

GUIDE PLATE**Figure 28**

Tool Required:

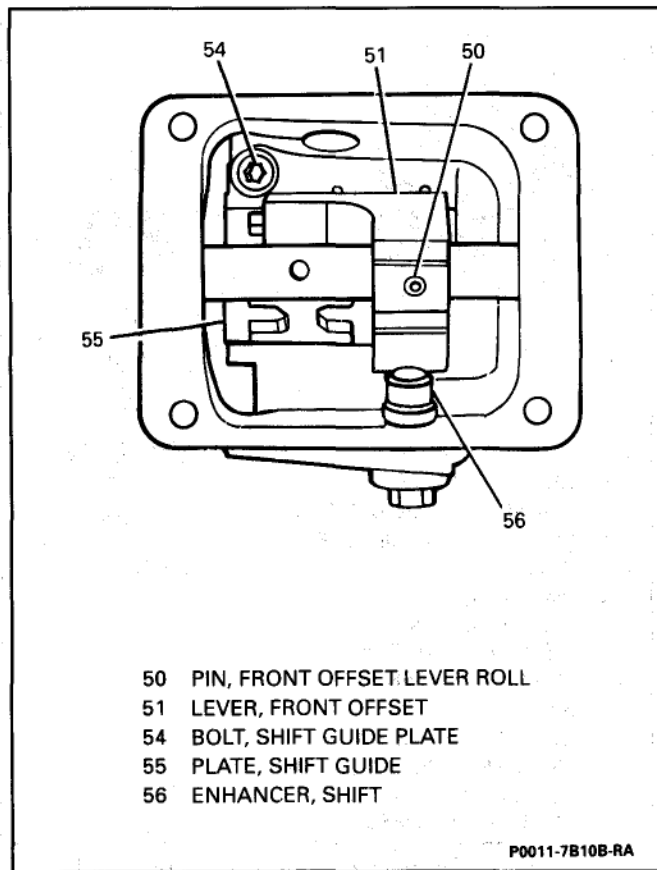
J 36850 Transmission Assembly Lube

Install or Connect

1. Guide plate (55).
2. Shift guide plate bolts (54).

Tighten

- Bolts (54) to 22 N·m (16 lb. ft.).

**Figure 28 Shift Detent Assembly****TRANSMISSION CASE****Figures 28 and 29**

Tool Required:

J 36850 Transmission Assembly Lube

Install or Connect

- Lubricate all components as assembly progresses. Use J 36850 Transmission Assembly Lube.

1. Sealant GM p/n 12345739 at transmission case to adapter plate mating surface.
 - Assemble ball detent in offset lever.
2. Transmission case (44) and front offset lever (51).

Important

- Make sure transmission is in NEUTRAL to keep 3rd/4th shift rail from engaging.
 - Install solenoid lever (183).
 - Compress front offset lever (51) together while sliding onto shift rail (149) to prevent spring release of inner components.
 - Slide transmission case (44) onto gear clusters and shift rail components.
3. Shift lever guide bolts (45 and 46).
 - Apply anaerobic threadlocker GM p/n 12345382 to threads of shift lever guide bolts (45 and 46).
 - Pull up on 5th/6th and reverse shift rail assembly (140) enough to align the slot of the shift interlock plate (156) with guide bolt hole.

Tighten

- Bolts (45 and 46) to 27 N·m (20 lb. ft.).
4. Adapter plate to transmission case bolts (178).
 - Bolts (178) to 35 N·m (26 lb. ft.).
 5. Front offset lever roll pin (50).
 6. Roll pin (182).
 7. Shift detent assembly (56).

Tighten

- Apply anaerobic threadlocker GM p/n 12345382 to threads of shift detent assembly (56).
 - Shift detent assembly (56) to 40 N·m (30 lb. ft.).
8. Cover plate (48).
 - Apply sealant GM p/n 12345739 to mating surface of cover plate (48).
 9. Cover plate bolts (47).
 - Bolts (47) to 20 N·m (15 lb. ft.).
 10. Computer aided gear select solenoid (181).

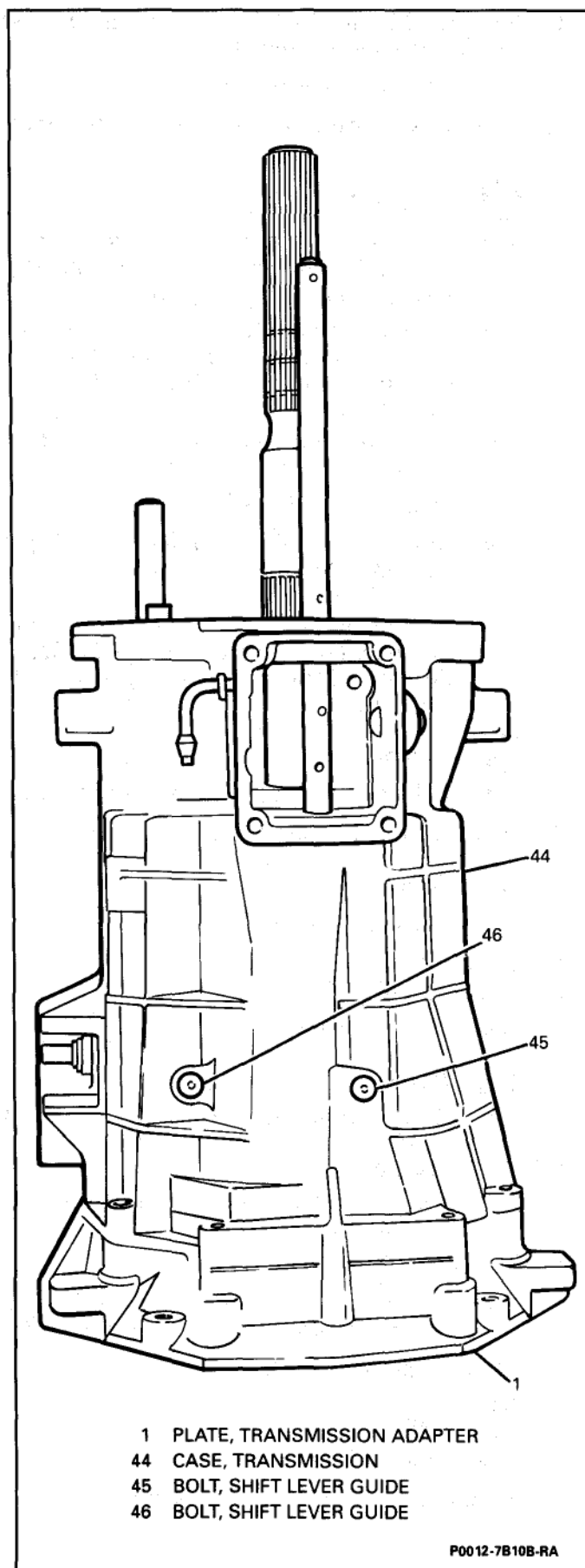


Figure 29 Transmission Case

COUNTERSHAFT EXTENSION ASSEMBLY

Figure 30

 Install or Connect

1. Countershaft extension assembly and 5th/6th shift fork (122) with transmission in horizontal position.
 - Ensure splines of countershaft extension (128) engage splines of countershaft (105).
2. 5th/6th shift fork snap ring (124).

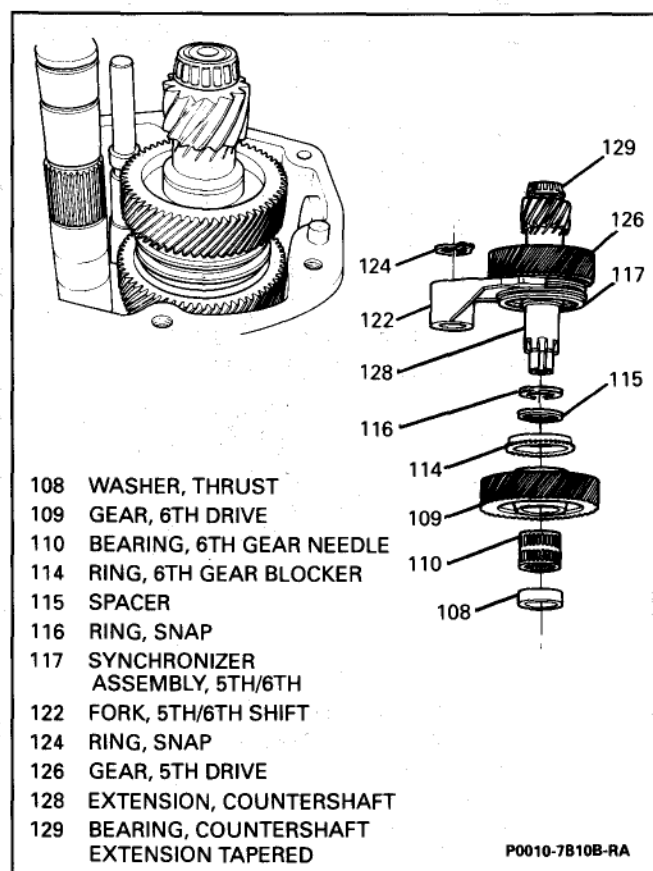


Figure 30 Countershaft Extension Assembly

5th/6th DRIVEN GEAR**Figure 31**

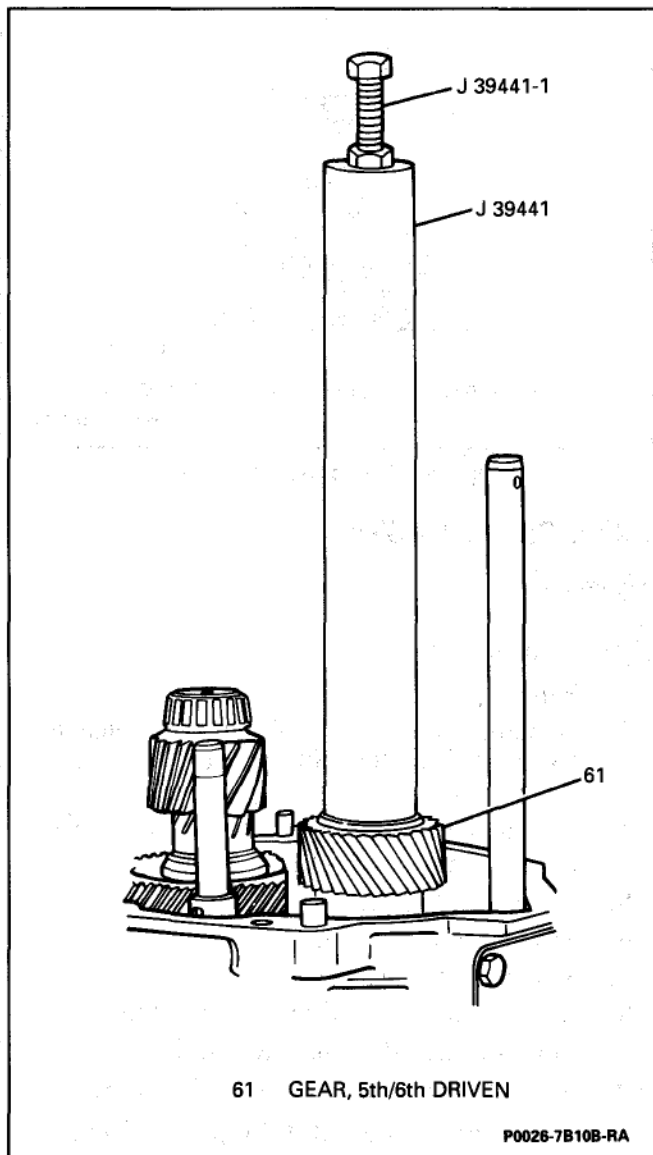
Tool Required:

J 39441 Gear Installer

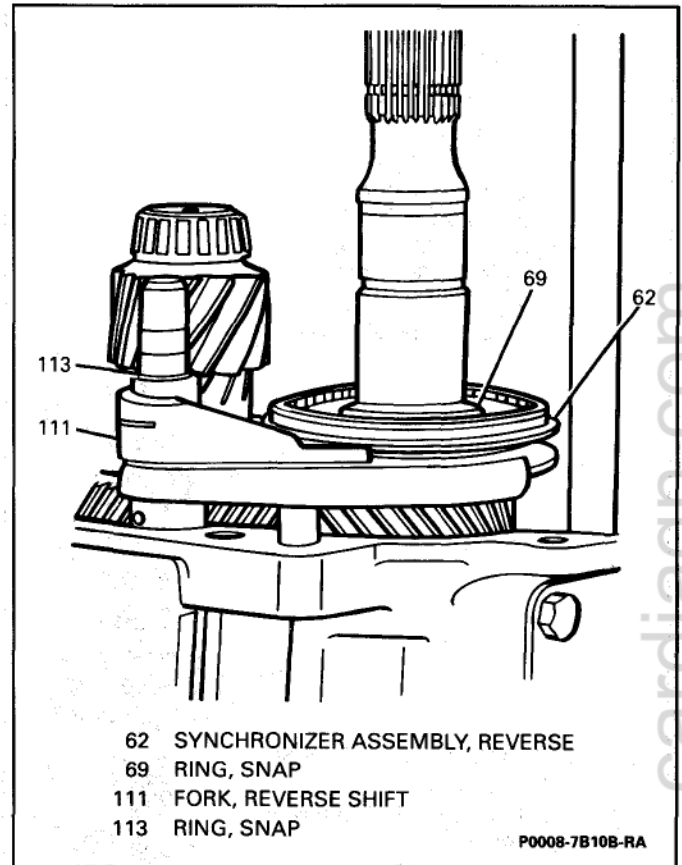
J 39441-1 Gear Installer Bolts

Install or Connect

- 5th/6th driven gear (61) using J 39441 and J 39441-1.
 - Smaller OD gear down.
 - Engage splines of 5th/6th driven gear (61) to shaft splines (23) before pressing gear onto shaft.

**Figure 31 5th/6th Driven Gear****REVERSE SHIFT FORK****Figure 32****Install or Connect**

1. Reverse shift fork (111), synchronizer (62) and thrust washer (68) at the same time.
2. New reverse shift fork snap ring (113).
3. Reverse synchronizer snap ring (69).

**Figure 32 Reverse Shift Fork****REVERSE SPEED GEAR****Figure 33****Install or Connect**

1. Blocker ring (70).
2. Wave washer (71).
 - Install wave washer (71) so concave side faces blocker ring (70).
3. Needle bearing (72).
4. Reverse speed gear (73).
5. Thrust washer (74).

6. Snap ring (75).
7. Spacer (76).
8. Roller bearing (77).
9. Spacer (78).
10. Roller bearing snap ring (79).

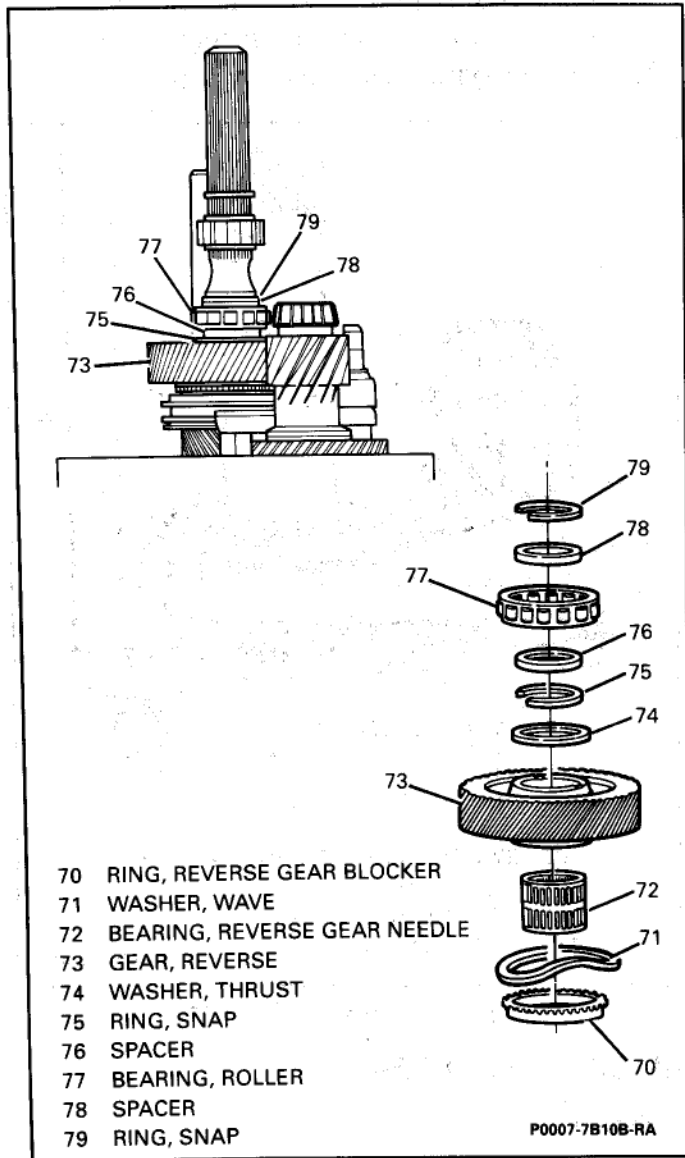


Figure 33 Reverse Speed Gear

SPEEDOMETER GEAR

Figure 34

Tool Required:

J 39441 Gear Installer

J 39441-2 Gear Installer Bolts

Install or Connect

1. Speedometer gear snap ring (80).
2. Speedometer gear (81) using J 39441 and J 39441-2.

3. Speedometer gear snap ring (82).
4. Sealing ring.

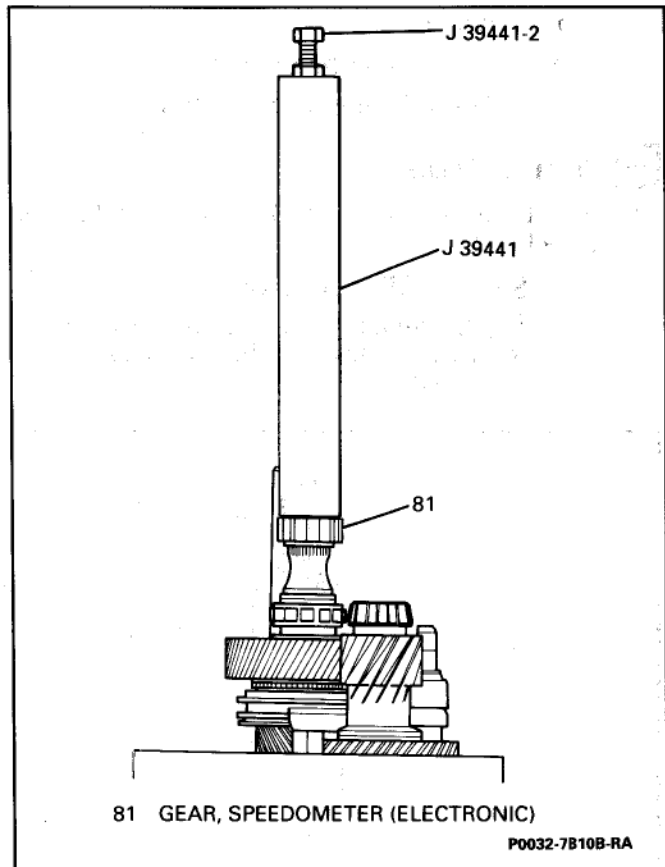


Figure 34 Speedometer Gear

EXTENSION HOUSING

Figure 35

Install or Connect

1. Funnel (132).
 2. Selective shim (131). Refer to "Countershaft Extension" under "Shimming Procedures" in this section.
 3. Countershaft extension bearing race (130).
 4. Reverse idler shaft (138).
 5. Thrust washer (139).
 6. Roller bearing (137).
 7. Reverse idler gear (136).
 8. Reverse idler gear thrust washer (135).
 9. Reverse idler shaft bracket (134).
 10. Reverse idler shaft bracket bolts (133).
- Apply sealant GM p/n 12345382 to threads of bolts (133).

Tighten

- Bolts (133) to 25 N·m (18 lb. ft.).

11. Extension housing (86).

- Apply sealant GM p/n 12345739 at extension housing to transmission case mating surface.
- Align 5th/6th and reverse shift rail (140) with extension housing bore.

12. Extension housing bolts (100) and transmission bumper (177).

 Tighten

- Apply sealant GM p/n 1052080 to threads of bolts retaining transmission bumper.
- Bolts (100) to 35 N·m (26 lb. ft.).

13. Rear offset shift lever (93) and isolator cup (95).

14. Rear offset shift lever roll pin (94).

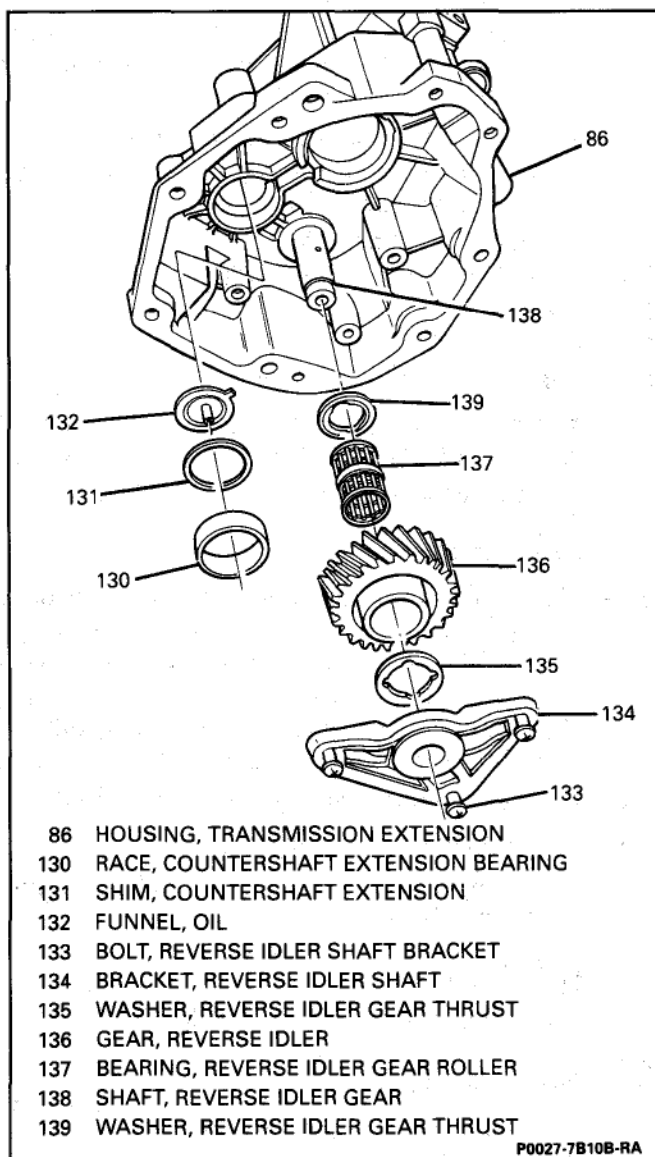


Figure 35 Extension Housing

SHIFTER**Figure 36** **Install or Connect**

1. Shifter (96).

- Apply sealant GM p/n 12345739 at extension housing to shifter mating surface.

2. Bolts (97).

 Tighten

- Bolts (97) to 20 N·m (15 lb. ft.).

3. Remove transmission from J 39430 and J 3289-20.

4. Clutch fork (164) and T-handle (165).

5. Clutch fork bolt (166).

 Tighten

- Apply sealant GM p/n 12345382 to threads of clutch fork bolt (166).
- Bolt (166) to 25 N·m (18 lb. ft.).

6. Clutch housing (162).

7. Clutch housing bolts (163).

 Tighten

- Bolts (163) to 35 N·m (26 lb. ft.).

8. Vent tube (161).

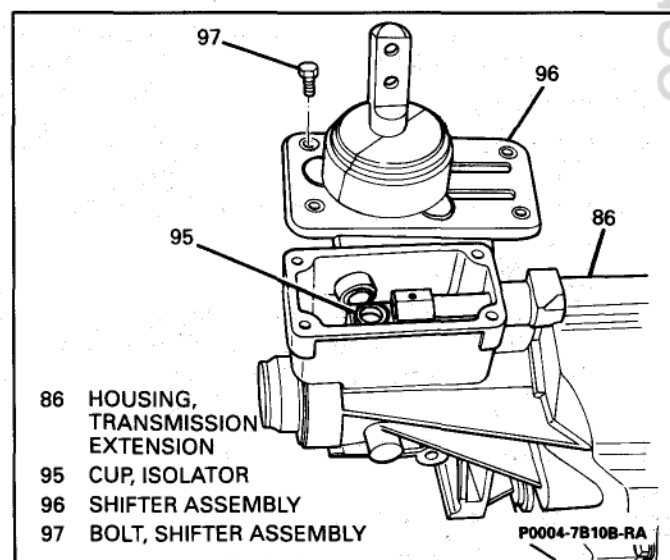


Figure 36 Shifter

SHIMMING PROCEDURES

INPUT SHAFT/MAINSHAFT AND COUNTERSHAFT

Figure 37

Tools Required:

- J 8001 Dial Indicator Set
- J 39444-1 Countershaft End Play Measuring Tool

Install or Connect

1. Position transmission in vertical position.
2. Input shaft (10) to adapter plate (1).
3. Mainshaft (23) to input shaft (10).
4. Countershaft (105).
 - A. Lift up mainshaft (23) enough to install countershaft (105).
 - B. Countershaft (105).
5. Transmission case (44).
6. Adapter plate to transmission case bolts (178).

Tighten

- Bolts (178) to 35 N·m (26 lb. ft.).

7. Place tip of J 8001 on end of mainshaft (23).

Measure

- A. Input shaft/mainshaft end play by moving input shaft (10) up and down.
 - B. Select shim (6) to achieve 0.000 to 0.002 inch (0.00 to 0.05 mm) preload.
8. Remove J 8001.
9. Place tip of J 8001 on end of countershaft (105).
10. J 39444-1 through adapter plate plug hole.

Measure

- A. Countershaft end play using J 39444-1 to move countershaft (105) up and down.
 - B. Select shim (102) to achieve 0.000 to 0.002 inch (0.00 to 0.05 mm) preload.
11. Remove J 39444-1 and J 8001.

Remove or Disconnect

1. Adapter plate to transmission case bolts (167).
2. Transmission case (44).
3. Countershaft (105).
 - A. Lift up mainshaft (23) enough to remove countershaft (105).
 - B. Countershaft (105).
4. Mainshaft (23).
5. Input shaft (10) from adapter plate (1).

6. Input shaft bearing race (8).
7. Countershaft bearing race (103).

COUNTERSHAFT EXTENSION

Figure 38

Tools Required:

- J 8001 Dial Indicator Set
- J 39444-2 Countershaft Extension End Play Measuring Rod

Install or Connect

Important

- This procedure cannot be performed accurately until the "Countershaft Shimming Procedure" has been completed and the transmission has been assembled to the point of installing the countershaft extension.

1. Position transmission in horizontal position.
2. Countershaft extension (128) to countershaft (105) making sure splines fully engage.
3. Extension housing (86).
4. Extension housing bolts (100).

Tighten

- Bolts (100) to 35 N·m (26 lb. ft.).

5. J 39444-2 through adapter plate plug hole and screw J 39444-2 into countershaft extension.
7. J 8001 so tip is on end of J 39444-2.

Measure

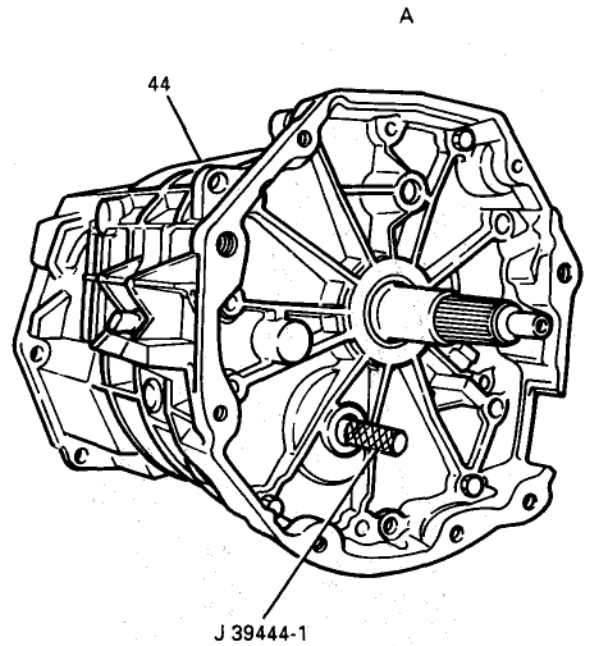
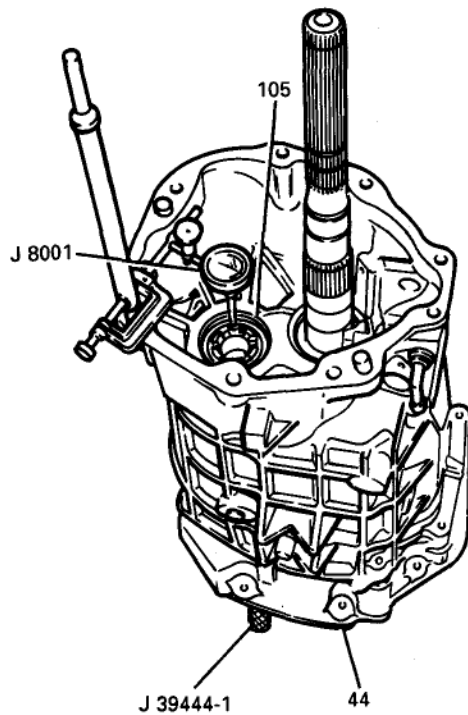
- A. Position transmission in vertical position.
 - B. Countershaft extension end play using J 39444-2 to move countershaft extension (128) up and down.
 - C. Select shim (131) to achieve 0.002 to 0.005 inch (0.05 to 0.13 mm) axial play.
8. Remove J 8001 and J 39444-2.
9. Install adapter plate plug (2).
 - Apply sealant GM p/n 1052080 to plug threads (2).

Tighten

- Plug (2) to 27 N·m (20 lb. ft.).

Remove or Disconnect

1. Extension housing bolts (100).
2. Extension housing (86).
3. Countershaft extension (128).
4. Countershaft extension bearing race (130).



- A COUNTERSHAFT SHIMMING PROCEDURE
 B INPUT SHAFT/MAINSHAFT SHIMMING PROCEDURE
 10 SHAFT, INPUT
 23 MAINSHAFT
 44 CASE, TRANSMISSION
 105 COUNTERSHAFT

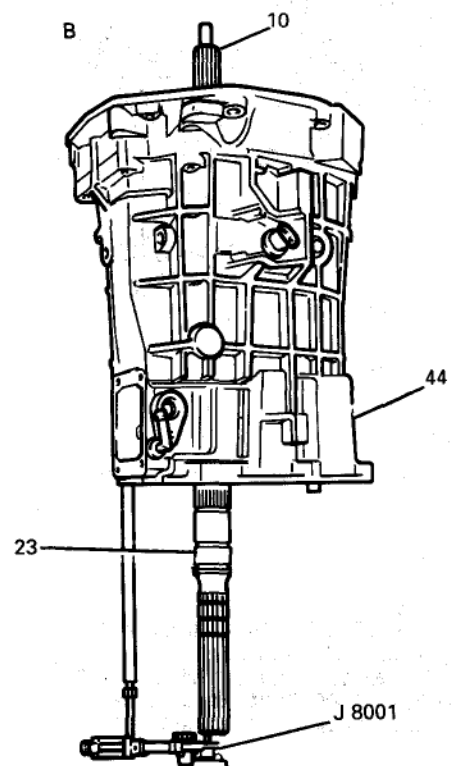
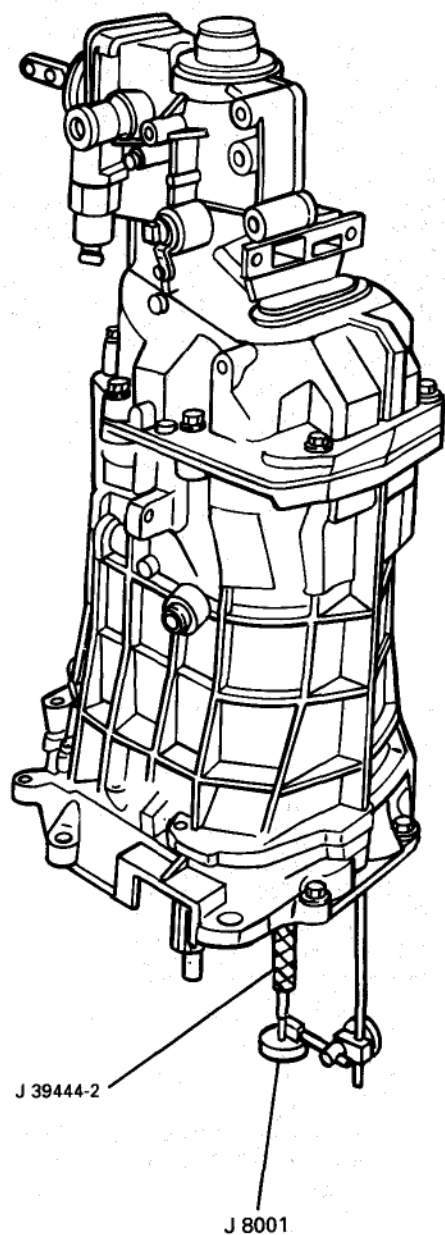


Figure 37 Input Shaft/Mainshaft and Countershaft



**NOTE: COUNTERSHAFT SHIMMING
PROCEDURE MUST BE
PERFORMED FIRST. COUNTERSHAFT
AND CORRECT SHIM MUST BE IN-
STALLED DURING THIS PROCEDURE**

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Figure 38 Countershaft Extension

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

NO.*	DESCRIPTION	TORQUE
2	Adapter Plate Plug	27 N•m (20 lb. ft.)
178	Adapter Plate to Transmission Case Bolts	35 N•m (26 lb. ft.)
59	Backup Lamp Switch	27 N•m (20 lb. ft.)
166	Clutch Fork Bolt	25 N•m (18 lb. ft.)
163	Clutch Housing to Adapter Plate Bolt	35 N•m (26 lb. ft.)
48	Cover Plate Bolts	20 N•m (15 lb. ft.)
101	Extension Housing Plug	27 N•m (20 lb. ft.)
100	Extension Housing to Transmission Case Bolts	35 N•m (26 lb. ft.)
133	Reverse Idler Shaft Bracket Bolts	25 N•m (18 lb. ft.)
90	Reverse Lockout Assembly Bolt	18 N•m (13 lb. ft.)
89	Reverse Lockout Solenoid	40 N•m (30 lb. ft.)
97	Shifter Bolts	20 N•m (15 lb. ft.)
56	Shift Detent Assembly	40 N•m (30 lb. ft.)
45, 46	Shift Lever Guide Bolts	27 N•m (20 lb. ft.)
54	Shift Guide Plate Bolts	22 N•m (16 lb. ft.)
60	Transmission Case Fill Plug	27 N•m (20 lb. ft.)
88	Vehicle Speed Sensor Bolt	10 N•m (89 lb. in.)

*Disassembled Parts Illustration, Figure 1

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SHIMMING SPECIFICATIONS

SHIM NO.*	DESCRIPTION	SHIM TO ATTAIN
7	Input Shaft/Mainshaft Shim	Preload of 0.0-0.002 inch (0.0 to 0.05 mm)
102	Countershaft Shim	Preload of 0.0-0.002 inch (0.0 to 0.05 mm)
131	Countershaft Extension Shim	Axial Play of 0.002-0.005 inch (0.05 to 0.13 mm)

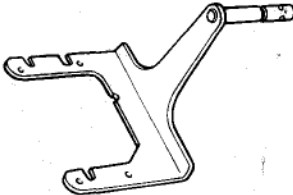
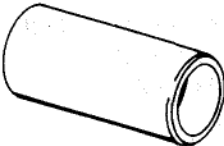
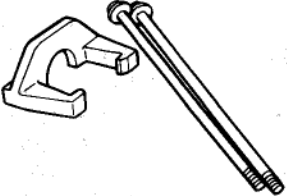
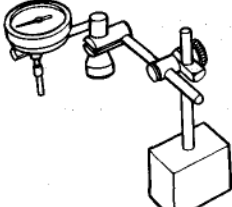
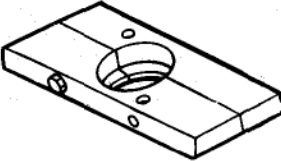
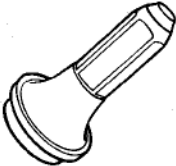
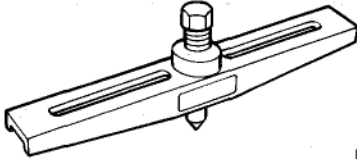
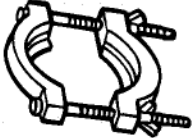
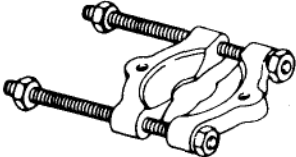
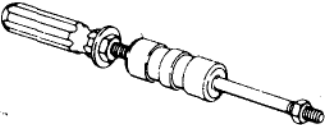
*Disassembled Parts Illustration, Figure 1

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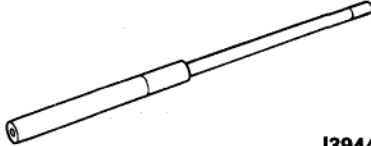
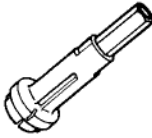
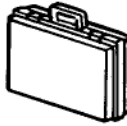
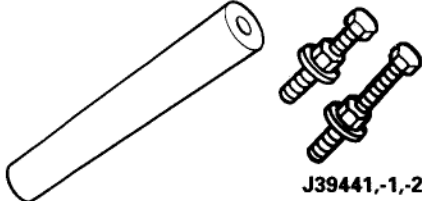
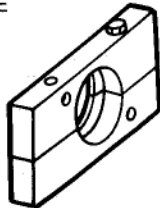
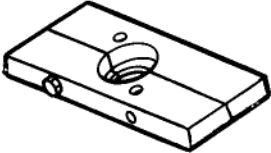
LUBRICANT SPECIFICATIONS

Lube Capacity (Approximate) 3.9 Liters (4.1 Quarts)
 After refill, fluid level must be checked as outlined under On-Vehicle Service in Section 7B.
 Recommended Lube.....Dexron®-III, -IIE

SPECIAL TOOLS

HOLDING FIXTURE  J3289-20	BEARING RACE INSTALLER  J28537-17	TRANSMISSION HOLDING FIXTURE  J39430
PRESS TUBE  J5590	PRESS TUBE  J36183	GEAR REMOVER AND BOLTS  J39431,-1,-2
DIAL INDICATOR SET  J8001	PRESS TUBE ADAPTER  J36184	SPLIT PLATE  J39428
UNIVERSAL DRIVE HANDLE  J8092	DRIVE HANDLE  J36190	SEAL INSTALLER  J39433
UNIVERSAL BRIDGE PULLER  J8433	SPLIT PLATE  J36513	BEARING RACE INSTALLER  J39435
SPLIT PLATE  J22912-01	BUSHING REMOVER  J36800	BEARING RACE INSTALLER  J39436
SLIDE HAMMER  J23907	1ST/2ND SYNCHRONIZER INSTALLER  J39371	BUSHING INSTALLER  J39437 P0030-7B10B-RA

SPECIAL TOOLS (CONT.)

BEARING INSTALLER  J39438	COUNTERSHAFT END PLAY ROD  J39444-1	PRESS ADAPTER  J39547
BUSHING REMOVER/INSTALLER  J39439-1	COUNTERSHAFT EXTENSION END PLAY ROD  J39444-2	BEARING RACE REMOVER  J39594
REAR SEAL AND BOOT INSTALLER  J39440	STORAGE CASE  J39445	BEARING RACE REMOVER  J39789
GEAR INSTALLER AND BOLTS  J39441, -1, -2	BEARING INSTALLER/ADAPTER  J39473	BEARING RACE REMOVER  J39790
PRESS ADAPTER  J39442	SPLIT PLATE  J39511	BEARING RACE REMOVER  J39791
SPLIT PLATE  J39443	BEARING RACE INSTALLER  J39546	

