



"2001" SEMINAR INFORMATION "PRACTICAL TECH"

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AUTOMATIC TRANSMISSION SERVICE GROUP

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Miami, Florida 33156



INTRODUCTION

The third and final manual for the "2001 NEW MILLENNIUM EDITION" seminar continues to present practical information on Chrysler vehicles and then Imports. In staying up with today's technology it only makes sense that only ATSG can bring you the latest in technology. Available no where else, ATSG is the best GLOBAL technical service company for transmission shops who want to stay in business. Only the best attend these seminars keeping themselves up to date and they alone will remain in a profitable business.

**The information and part numbers contained in this booklet have
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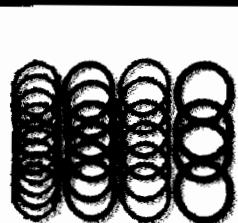
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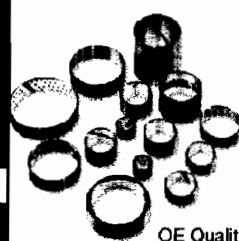
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ACURA LEGEND WITH G4, L5 & PL5X TRANSAXLES GRINDING OR BIND-UP IN REVERSE

COMPLAINT: When a garage shift is made into reverse, the transmission emits a grinding noise and/or a bind-up condition. This complaint usually occurs when one or more of the reverse selector components on the counter shaft are changed.

CAUSE: Incompatible counter shaft reverse selector components have been installed. These components for the G4, L5 and PL5X, at a glance, look alike, **THEY ARE NOT!**

NOTE: *The original equipment G4 components were used in the 1987 Legend Coupe only, with the L5 transaxle.*

CORRECTION: *Figure 1* illustrates the differences in the G4, Early L5 reverse counter shaft components. Take notice of the diameter of the components as well as tooth and spline configuration. The reverse servo uses a return spring to return the reverse servo to the fourth gear position.

Figure 2 illustrates the differences in the Late L5 reverse counter shaft components. Take notice of the diameter of the components as well as spline and tooth configuration. The reverse servo also utilizes a return spring to return the reverse servo to the fourth gear position.

Figure 3 illustrates the differences in the PL5X reverse counter shaft components. The component diameters are the same as the Late L5 components, but, the spline and tooth configurations have changed. The PL5X does **NOT** use a servo return spring, it uses a detent mechanism to keep the reverse servo in the reverse or fourth gear position. The fork is also different than the previous designs in that it is ribbed to accommodate the detent mechanism.

CAUTION: Honda/Acura internal components look very similar, ***always*** look closely to avoid this or any of the many other complaints that incompatible parts can cause.
Even though parts look the same, there can be slight dimensional differences, because clearances in most Honda/Acura units is .003" to .006" there is little room for error, always check end play before final assembly of the transmission.

Many thanks to Brett Bogan from



for his assistance in compiling this information.

ACURA LEGEND WITH G4, L5 & PL5X TRANSAXLES

GRINDING OR BIND-UP IN REVERSE

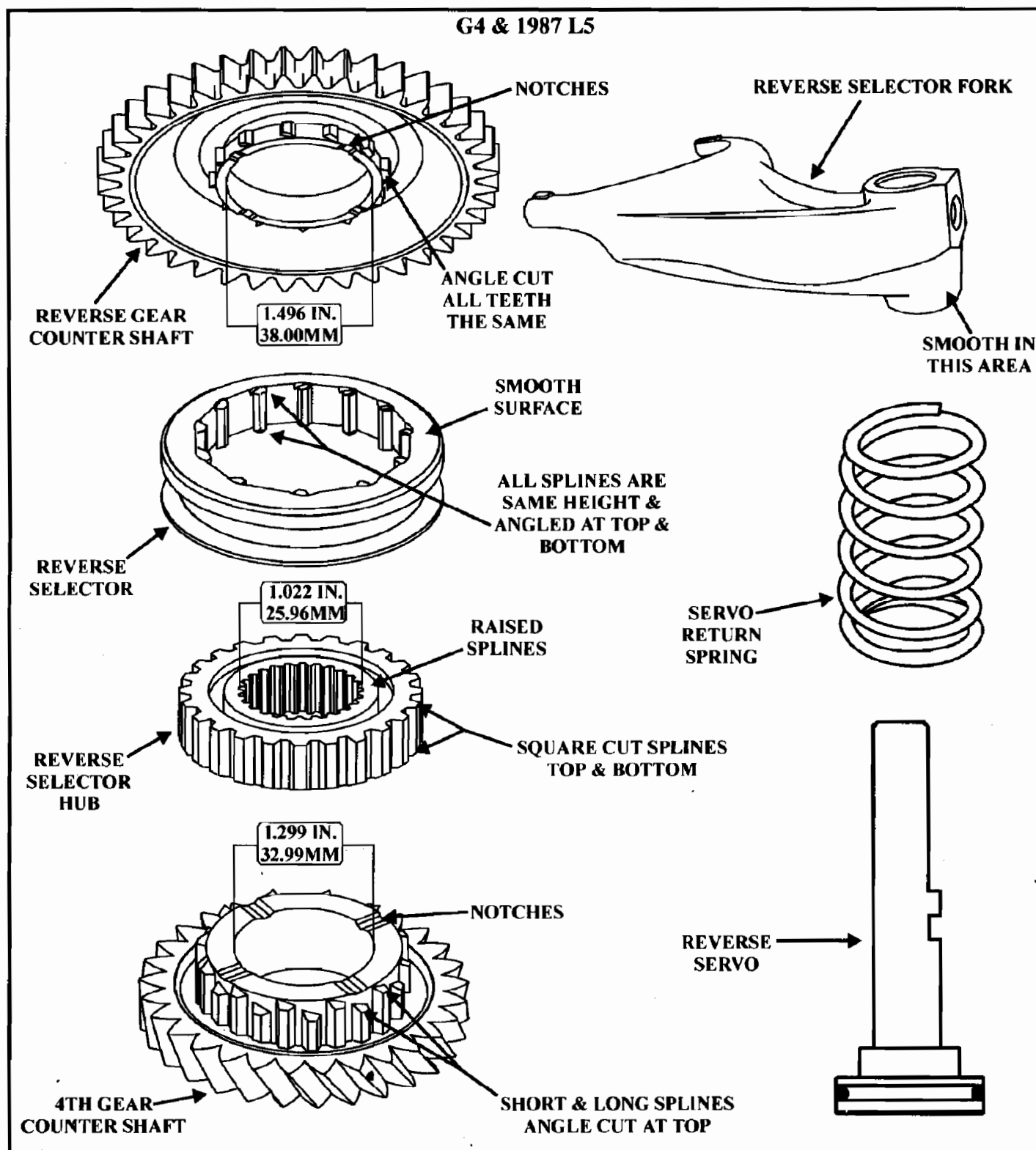


Figure 1

ACURA LEGEND WITH G4, L5 & PL5X TRANSAXLES

GRINDING OR BIND-UP IN REVERSE

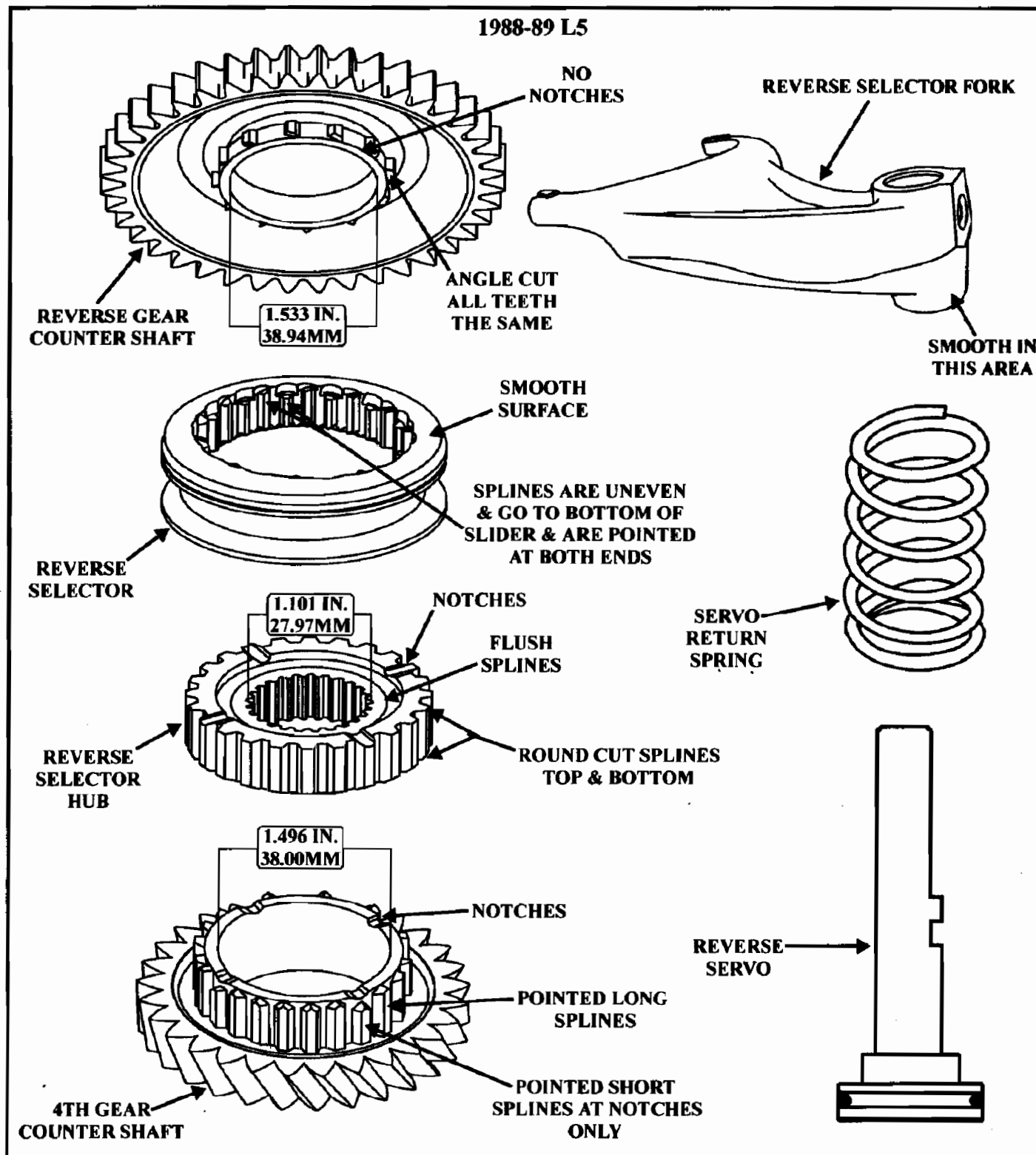


Figure 2

ACURA LEGEND WITH G4, L5 & PL5X TRANSAXLES

GRINDING OR BIND-UP IN REVERSE

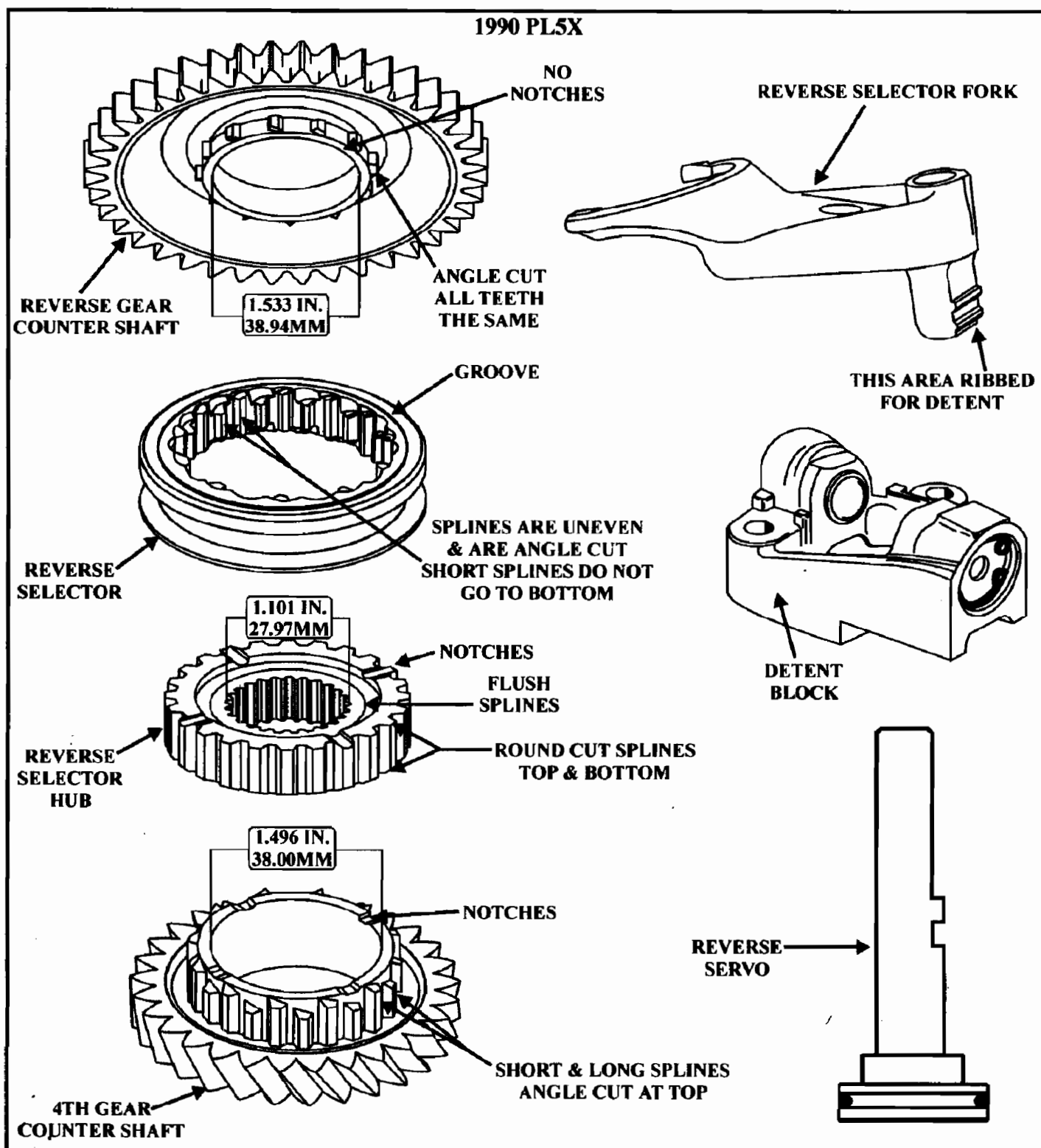


Figure 3

MAZDA/FORD GF4A-EL

HARSH UPSHIFTS

(ELECTRICAL)

COMPLAINT: Vehicles equipped with GF4A-EL transmissions may exhibit harsh shifts, accompanied by a trouble code 56 or OBDII code P0710, Transmission Temperature Sensor Fault.
NOTE: *These trouble codes may or may not flash the M.I.L.*

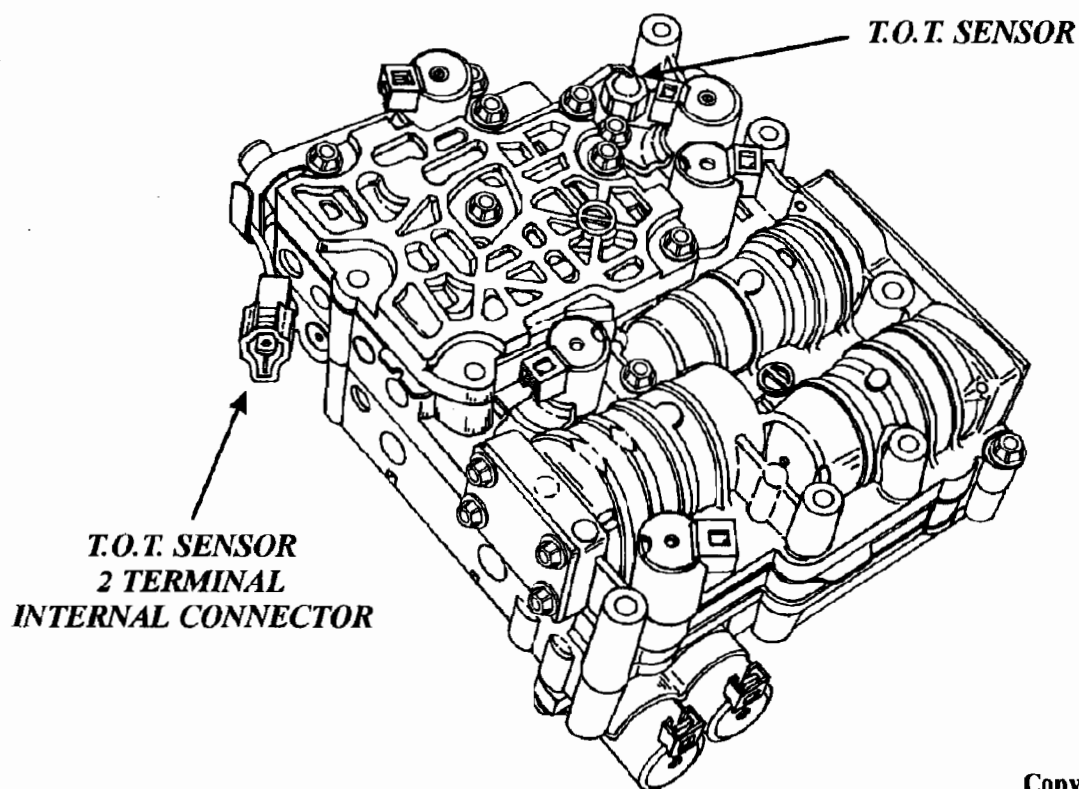
CAUSE: The cause may be, a faulty Transmission Temperature Sensor. **WHY:** Vehicles equipped with GF4A-EL transmissions have a computer strategy that *commands* line pressure to be maximum when fluid temperature is at or below 10°F. Therefore if the temperature sensor is faulty it may indicate that temperature is at or below 10°F at all times.

CORRECTION: Refer to Figure 1 for the location of the Transmission Oil Temperature Sensor. Refer to Figure 2 for the Ohm value and testing procedure to check the sensor. Refer to Figure 3 for the testing procedure of the sensor at the 10 pin connector. Repair or replace temperature sensor as necessary.

SERVICE INFORMATION:

Transmission Oil Temperature Sensor (MAZDA)..... FU2B-19-012B

GF4A-EL TRANSMISSION OIL TEMPERATURE SENSOR LOCATION



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Figure 1

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°Harsh 1-2 Shift & Stacked 2-3-4 °Slip or flare 2-3 & 3-4 shift
 °Delayed/NO Engagement to Drive & Reserve °Slip during take off

°Clunk or harsh downshift °No passing gear condition

°Kalibrate & extent or shorten shifting pattern

°TV plunger suck in DR position/No Shifting

°First-gear-start valve-body conversion Kit

°Broken springs, valves & misc. in valve body

°Air-test plate for 722.3,4,5 & Porsche 928

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°Rebuilt & Re-Engineered Valve-bodies

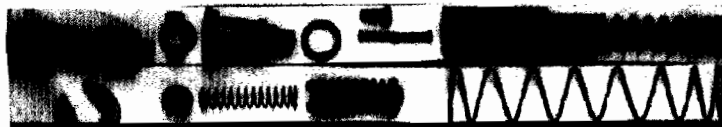
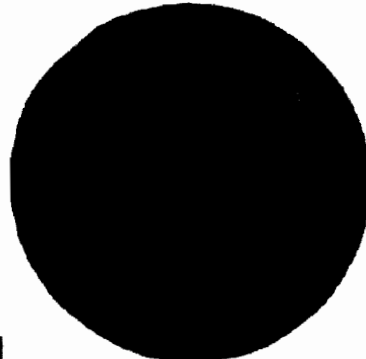
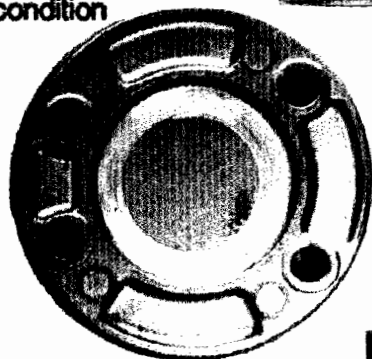
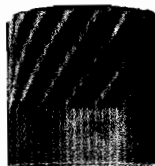
°722.4 Rear Pump & Governor Retrofit Fix

°MERCEDES BENZ hard parts 1962 to 1995

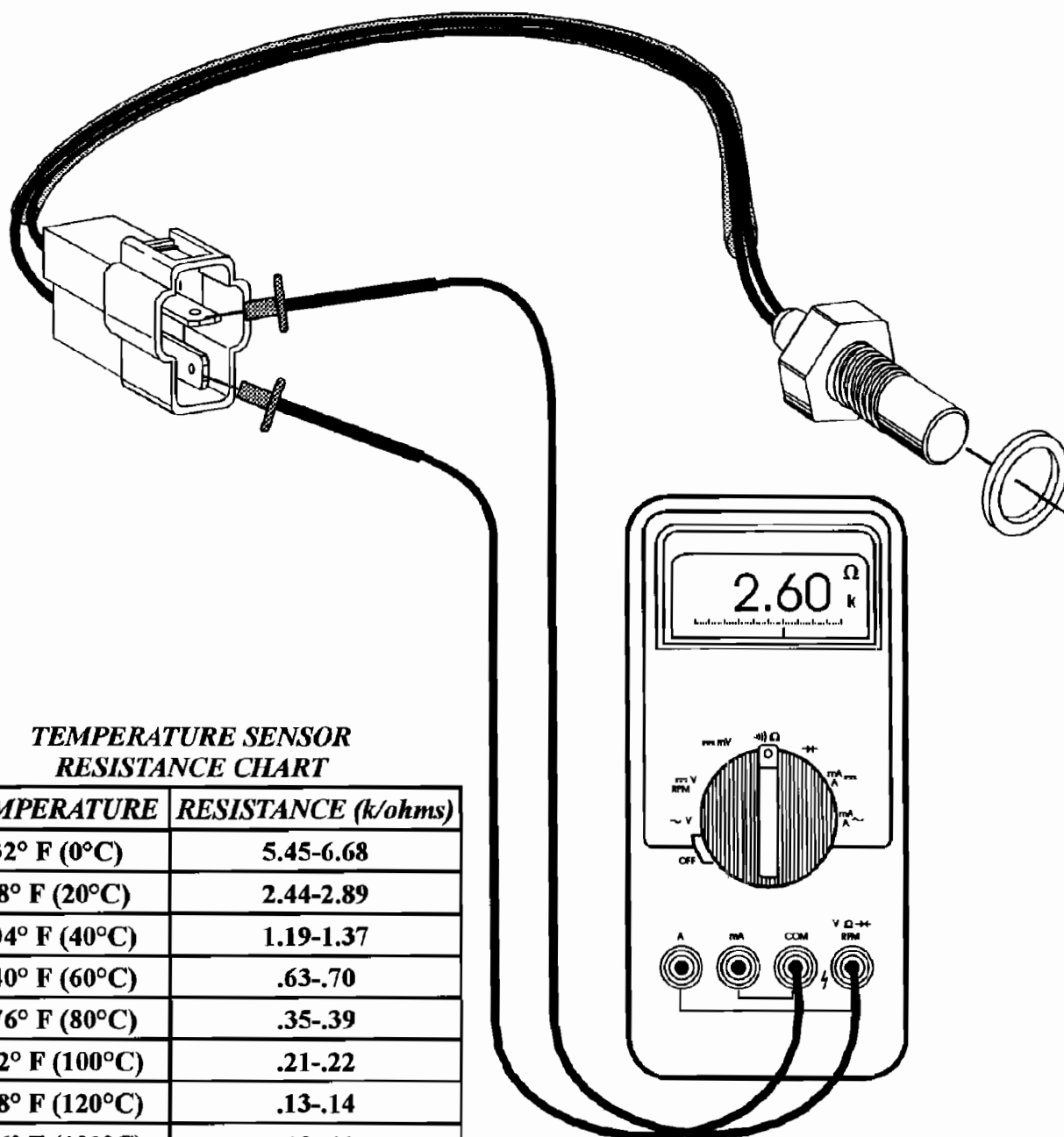
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°Technical Assistant in English & Spanish; German via fax

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BENCH TESTING TEMPERATURE SENSOR



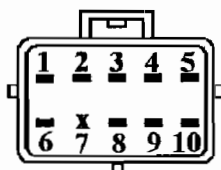
**TEMPERATURE SENSOR
RESISTANCE CHART**

TEMPERATURE	RESISTANCE (k/ohms)
32° F (0°C)	5.45-6.68
68° F (20°C)	2.44-2.89
104° F (40°C)	1.19-1.37
140° F (60°C)	.63-.70
176° F (80°C)	.35-.39
212° F (100°C)	.21-.22
248° F (120°C)	.13-.14
266° F (130°C)	.10-.11

**CONNECT OHM METER TO THE 2 TERMINALS SHOWN ABOVE
AND VERIFY THAT THE RESISTANCE VALUES MATCH THE TEMPERATURE**

Figure 2

10 PIN HARNESS CONNECTOR TERMINAL IDENTIFICATION



TERMINAL	IDENTIFICATION	INTERNAL WIRE COLOR
1	TEMP.SENSOR	WHITE
2	LINE PRESSURE	BLUE
3	3-2 DOWNSHIFT	BLACK
4	3-4 SHIFT	BROWN
5	1-2 SHIFT	BLACK
6	TEMP.SENSOR	WHITE
7	N / A	N / A
8	LOCKUP	YELLOW
9	LOCKUP CONTROL	WHITE
10	2-3 SHIFT	GREEN

TEMPERATURE SENSOR RESISTANCE CHART

TEMPERATURE	RESISTANCE (k/ohms)
32° F (0°C)	5.45-6.68
68° F (20°C)	2.44-2.89
104° F (40°C)	1.19-1.37
140° F (60°C)	.63-.70
176° F (80°C)	.35-.39
212° F (100°C)	.21-.22
248° F (120°C)	.13-.14
266° F (130°C)	.10-.11

DIS-CONNECT 10 PIN CONNECTOR AND CONNECT OHM METER TO TERMINALS 1 AND 6 TO VERIFY THAT RESISTANCE VALUES MATCH THE TEMPRATURES LISTED ABOVE

BACK PROBE TERMINALS 1 AND 6, WITH 10 PIN CONNECTOR CONNECTED, VOLT METER SET TO DC VOLTS, TO VERIFY VOLTAGE.

68°F (20°C) IS EQUAL TO APPROXIMATELY 3.5 VOLTS

266°F (130°C) IS EQUAL TO APPROXIMATELY 0.6 VOLTS

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Figure 3

MAZDA/FORD GF4A-EL/GF4EAT HARSH UPSHIFTS

COMPLAINT: 1993 & up, vehicles equipped with GF4A-EL transaxles, may exhibit a harsh 1-2 upshift or harsh upshift complaints when "*hot*", before or after overhaul. Line pressure appears to be normal or slightly higher than normal 60-70 psi. at idle and 161-172 psi. at stall when checking in the "D" range when the vehicle is "*cold*." Although when the vehicle gets "*hot*" the pressures get erratic and or exceed the stall pressure specs, which are 175 psi. in "D" and 300 psi. in "Reverse."

CAUSE: The cause may be, a faulty Pressure Control Solenoid, a worn Boost Valve and Sleeve and/or a worn Pressure Regulator Valve bore which is part of the Rear Control Valve Body.

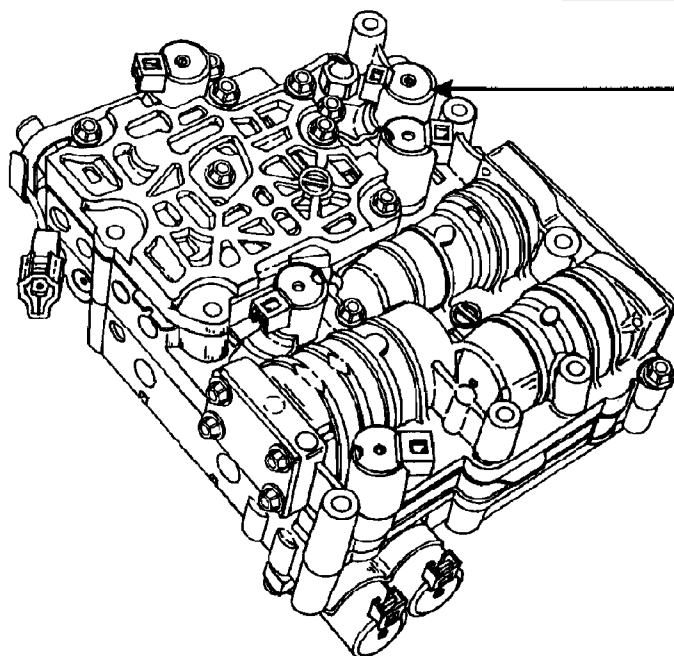
CORRECTION: Replace the Pressure Control Solenoid as shown in Figure 1, with Ford part number F32Z-7G136-AA or Mazda part number FU9A-21-1G1A. Inspect the Pressure Regulator Valve and the Pressure Regulator Valve bore for wear or scoring as shown in Figure 2. If the bore has "shiny" spots where the Valve rides a "New" Rear Control Valve Body can be purchased from Mazda. Inspect the Boost Valve and Boost Valve Sleeve for wear or scoring, and replace as needed with Sonnax boost valve and sleeve as shown in Figure 2.

SERVICE INFORMATION:

Pressure Control Solenoid (Ford Part No.).....	F32Z-7G136-AA
Pressure Control Solenoid (Mazda Part No.).....	FU9A-21-1G1A
Rear Control Valve Body (Mazda Part No.).....	FU9C-21-115G

NOTE: *This is a new casting with no valves in it.*

Boost Valve and Sleeve (Sonnax Part No.).....	74846-01K
-----------------------------------------------	-----------



PRESSURE CONTROL SOLENOID

FORD PART NO.
F32Z-7G136-AA

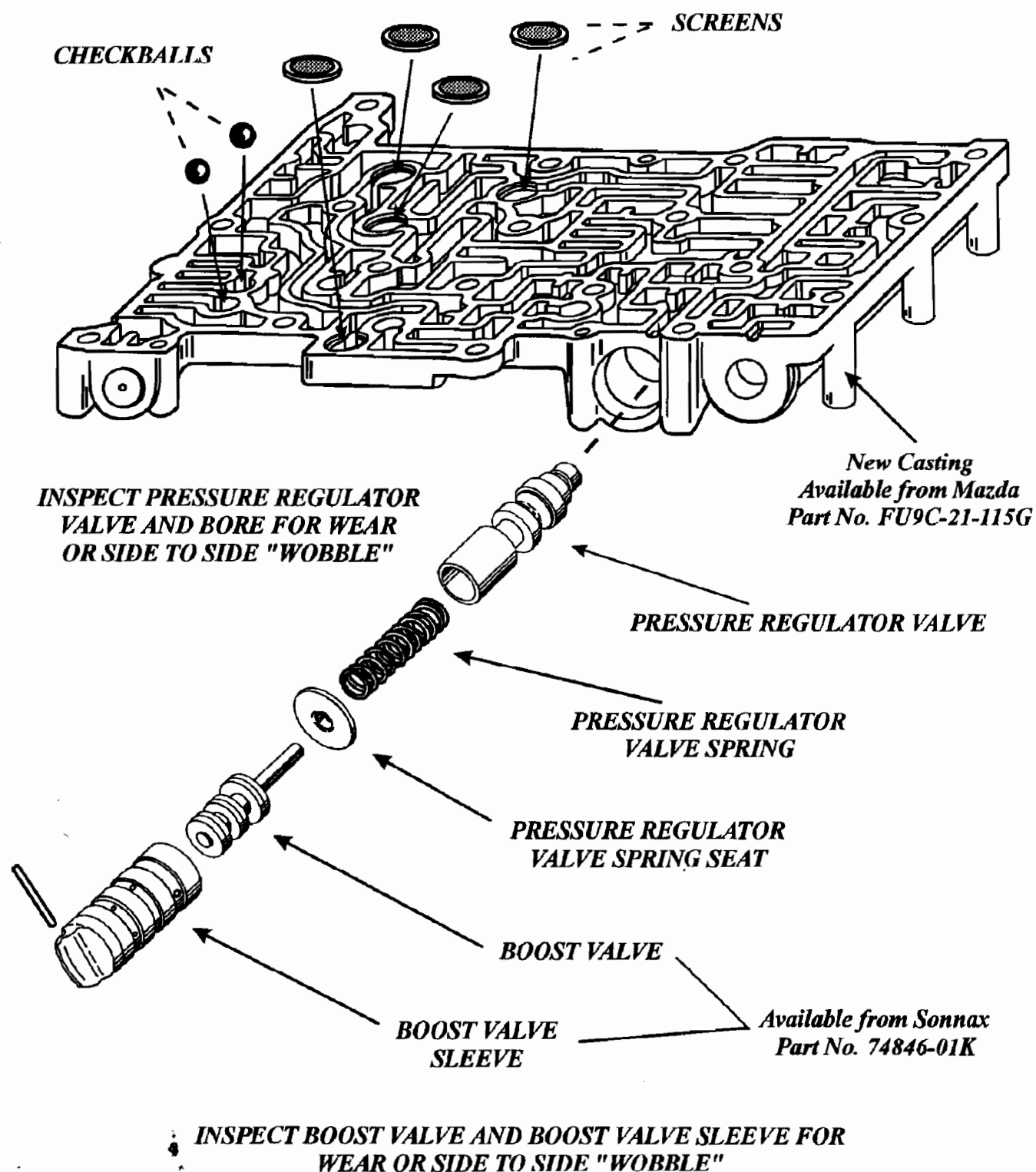
MAZDA PART NO.
FU9A-21-1G1A

NOTE: *These Part Numbers
Are For The Same Solenoid.*

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Figure 1

REAR CONTROL VALVE BODY



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Figure 2

BMW ZF-5HP-19FL

PRELIMINARY INFORMATION

FOUND IN:

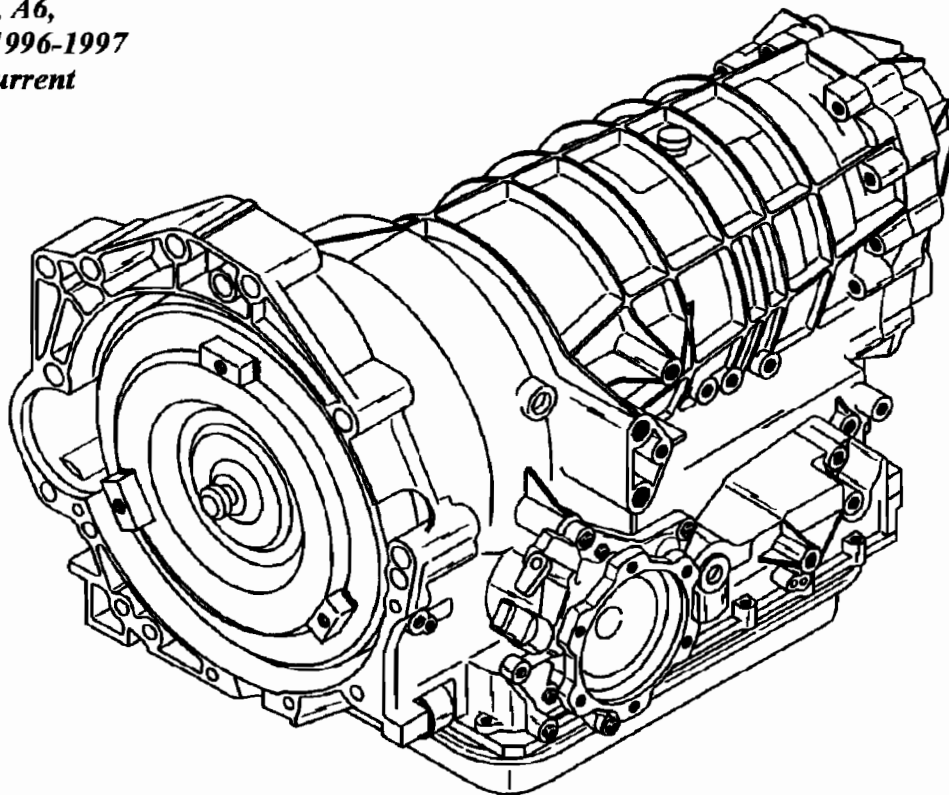
BMW 97-Current, 3 Series E46, 5 Series E39, 7 Series E38.

Audi 95-Current, A4, A8,

Audi 97-Current, A6,

Porsche Boxter 1996-1997

VW Passat 96-Current



This transmission is manufactured in Germany by ZF and carries the designation ZF-5HP-19

The ZF-5HP-19 Series is an electronically controlled, five speed automatic transmission with a lock-up clutch type torque converter. Two planetary gear sets, one Ravigneaux gear set and one standard planetary gear set on the output side, four rotating multiple disc clutches, three multiple disc brake clutches, and one sprag clutch (Freewheel) are used to provide the five forward speeds and reverse.

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Figure 1



"2001" SEMINAR INFORMATION

SLIDE

15

Refer to Figure 2 for Clutch and Band Application Chart.

Refer to Figure 3 and 4 for Manual Shift Lever Operation, and Failsafe Operation.

Refer to Figures 5, 6, and 7 for Solenoid identification and both MV Solenoid Operation and EDS Solenoid Operation and Tests.

Refer to Figure 8 for wiring harness identification, internal wiring schematic, and transmission case connector pin identification and functions.

Refer to Figure 9 for Shift Solenoid Application chart. Notice that EDS 1 Solenoid is used for line pressure control, and MV-4 is used for converter clutch.

Refer to Figure 10 for internal components resistance chart, with the pins identified for both the transmission case connector and the Electronic Control Unit.

Refer to Figure 11 for Upper Front Valve Body exploded view and identification of valves.

Refer to Figure 12 for Upper Rear Valve Body exploded view and identification of valves.

Refer to Figure 13 for Lower Front Valve Body exploded view and identification of valves.

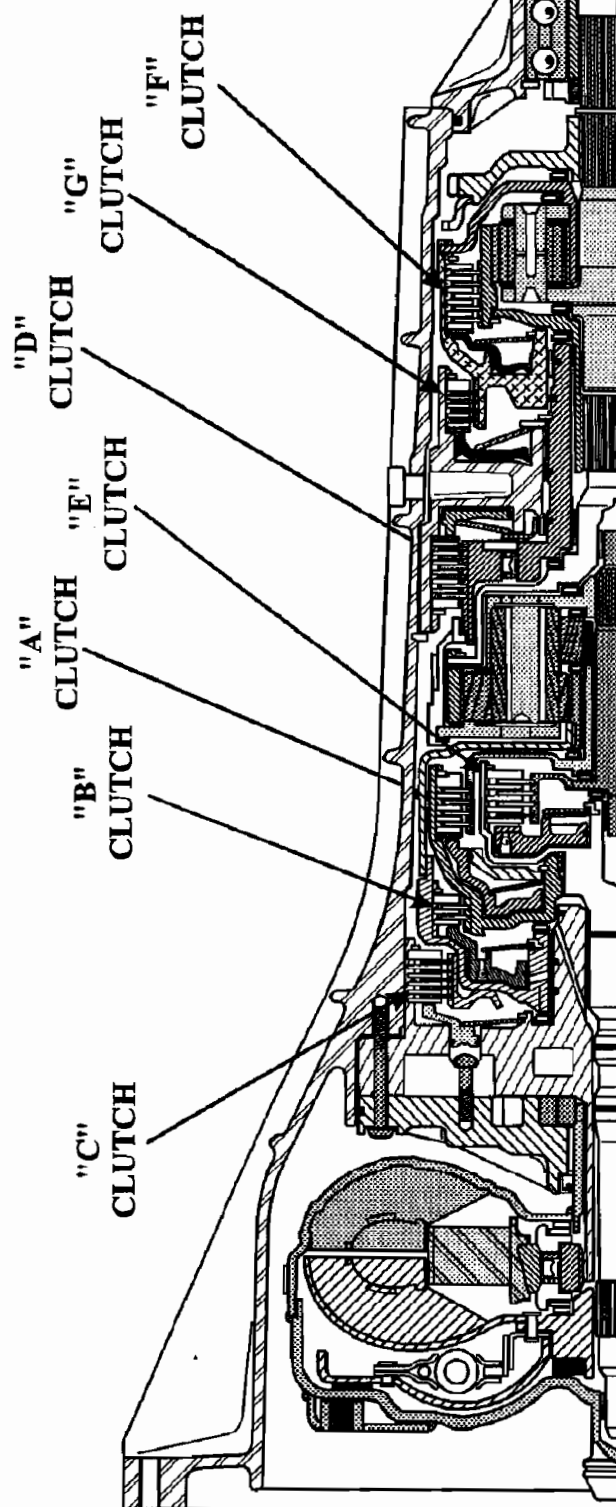
Refer to Figure 14 for Lower Rear Valve Body exploded view and identification of valves.

Refer to Figure 15 for Channel Plate exploded view and turbine speed sensor location on the channel plate.

Refer to Figures 16, 17, and 18 for valve body retainer locations in the various valve bodies.

Refer to Figure 19 for the locations of the orifices, checkballs, screens, and the check valves and springs that are located in the channel plate.

ZF-5HP-19 CLUTCH AND BAND APPLICATION CHART



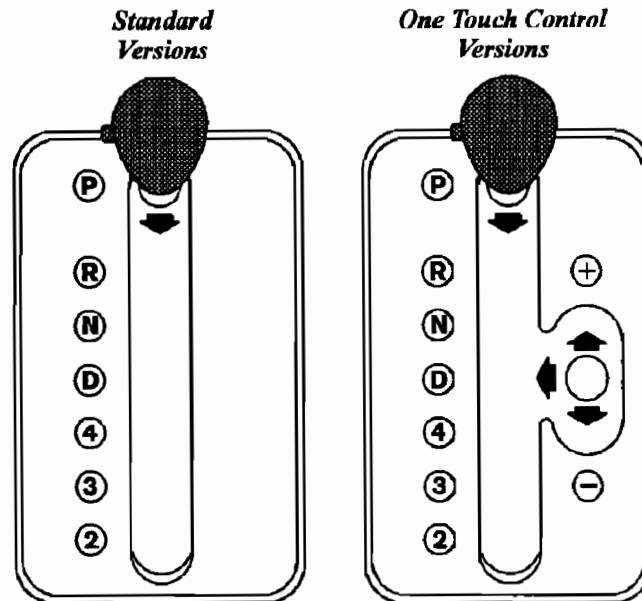
RANGE	"A" CLUT	"B" CLUT	"C" CLUT	"D" CLUT	"LOW" SPRAG	"E" CLUT	"F" CLUT	"G" CLUT	GEAR RATIO	CONV CLUT
Park								ON		
Reverse		ON		ON				ON	4.08	
Neutral								ON		
"D"-1st	ON				HOLD			ON	3.66	
"D"-2nd	ON		ON					ON	1.99	
"D"-3rd	ON		ON				ON		1.40	*
"D"-4th	ON					ON	ON		1.00	*
"D"-5th			ON			ON	ON		0.74	*
"4"	Same as above, Automatic Shift 1st thru 4th, 5th gear is inhibited.									
"3"	Same as above, Automatic Shift 1st thru 3rd, 4th and 5th gear are inhibited.									
"2"	Same as above, Automatic Shift 1st thru 2nd, 3rd, 4th and 5th gear are inhibited.									

*Converter Clutch may be ON or OFF depending on vehicle speed and throttle position.

Figure 2

SHIFT QUADRANT

- (P)** = Parking Pawl Engaged
- (R)** = Reverse Gear
- (N)** = Neutral
- (D)** = Automatic Shifts 1st thru 5th Gears
- (4)** = Automatic Shifts 1st thru 4th Gears.
5th Gear is locked out.
- (3)** = Automatic Shifts 1st thru 3rd Gears.
4th and 5th Gear is locked out.
- (2)** = Automatic Shifts 1st thru 2nd Gears.
3rd, 4th and 5th Gear is locked out.



Note: 1st gear, which has an engine braking effect, is selected electronically, dependent on being in Manual Position 2 and at a suitable road speed.

ONE-TOUCH CONTROL VERSIONS

Standard versions have a shift quadrant using only the left gate as shown above. The versions that are equipped with One-Touch Control, supplied as an option and model dependent, have a two section shift quadrant, also shown above. Positions P, R, N, D, 4, 3, 2, can be selected in the left-hand gate and all shifts are automatic depending on which selection was made. When the selector lever is placed in the right-hand gate, the transmission can be up-shifted manually, by tapping the lever in the direction of the "Plus" symbol, or down-shifted manually by tapping the lever in the direction of the "Minus" symbol. The separate program switch is no longer needed, as functions A and B have replaced it.

"A" Left-Hand Gate = DSP (Dynamic Shift Program)

With the selector lever in the left-hand gate, the Dynamic Shift Program (DSP) looks at the speed of accelerator pedal movement, engine speed, vehicle acceleration via output speed and other important parameters in the control unit.

The Electronic Control Unit (ECU) includes modules which will automatically modify the transmissions shift characteristics according to the driving style and the road conditions. These modules effectively replace the program switch.

If the engine temperature is below approximately 40°C (104°F) when it is started, the ECU control system enters a special warm-up program in order to shorten the catalytic converter's warming-up phase. This warm-up program is terminated after approximately 2 minutes of operation.

Continued on next Page

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Figure 3

"A" Left-Hand Gate = DSP (Dynamic Shift Program) (Cont'd)

If the speed of the accelerator pedal movement is greatly varied, the shift points are modified for maximum fuel economy, or a more sporting driving style accordingly. There are three shift patterns for this purpose.

- 1. = Comfort Oriented, Economical Driving Style**
- 2. = Average Driving Style**
- 3. = Sports Oriented, High Performance Driving Style**

When the vehicle is started cold, it moves off in shift pattern number one, provided that the transmission temperature is above 40°C (104°F). This shift pattern places the emphasis on maximum fuel economy. If a more enthusiastic driving style is required, detected by the accelerator opening and closing more rapidly, the ECU switches between the shift patterns and adopting shift pattern three where necessary.

If a calmer driving style is resumed, the ECU returns to the lower shift pattern, and will once again place the emphasis on fuel consumption.

"B" Right-Hand Gate = Manual Shift Program

When the selector lever is moved to the right-hand gate, the current gear is retained, and the transmission can be shifted to a lower or higher gear using the one-touch function.

There are engine speed limits for each gear, as in the transmission can only be shifted down if the maximum engine speed will not be exceeded by doing so. No mandatory upshifts will take place.

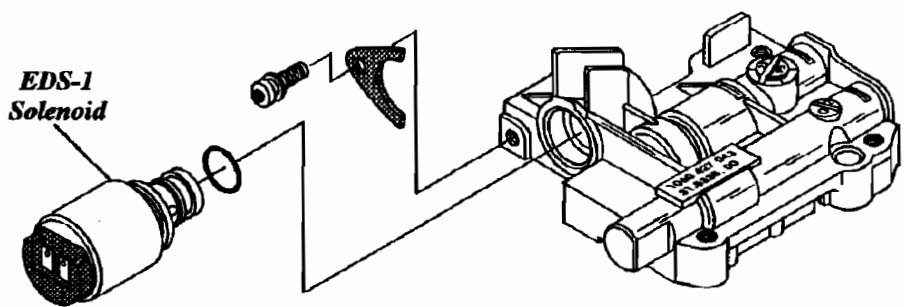
If the One-Touch feature is not used when the selector lever is in the right-hand gate, for durability concerns, the transmission is allowed to down-shift automatically to 1st gear.

FAILSAFE OPERATION

When a system fault is detected which could impair normal reliable operation, the ECU module interrupts the power supply to Pin 12 at the transmission case connector. The ECU module also alerts the driver of any faults by signaling the vehicles "check control" system. To enable the vehicle to be driven to a repair shop, the following manual gear selections are permitted:

Selector Lever Position	P R N D 4 3 2
Actual Gear Obtained	P R N 4 4 4 4

ZF-5HP-19 SOLENOID IDENTIFICATION AND LOCATIONS



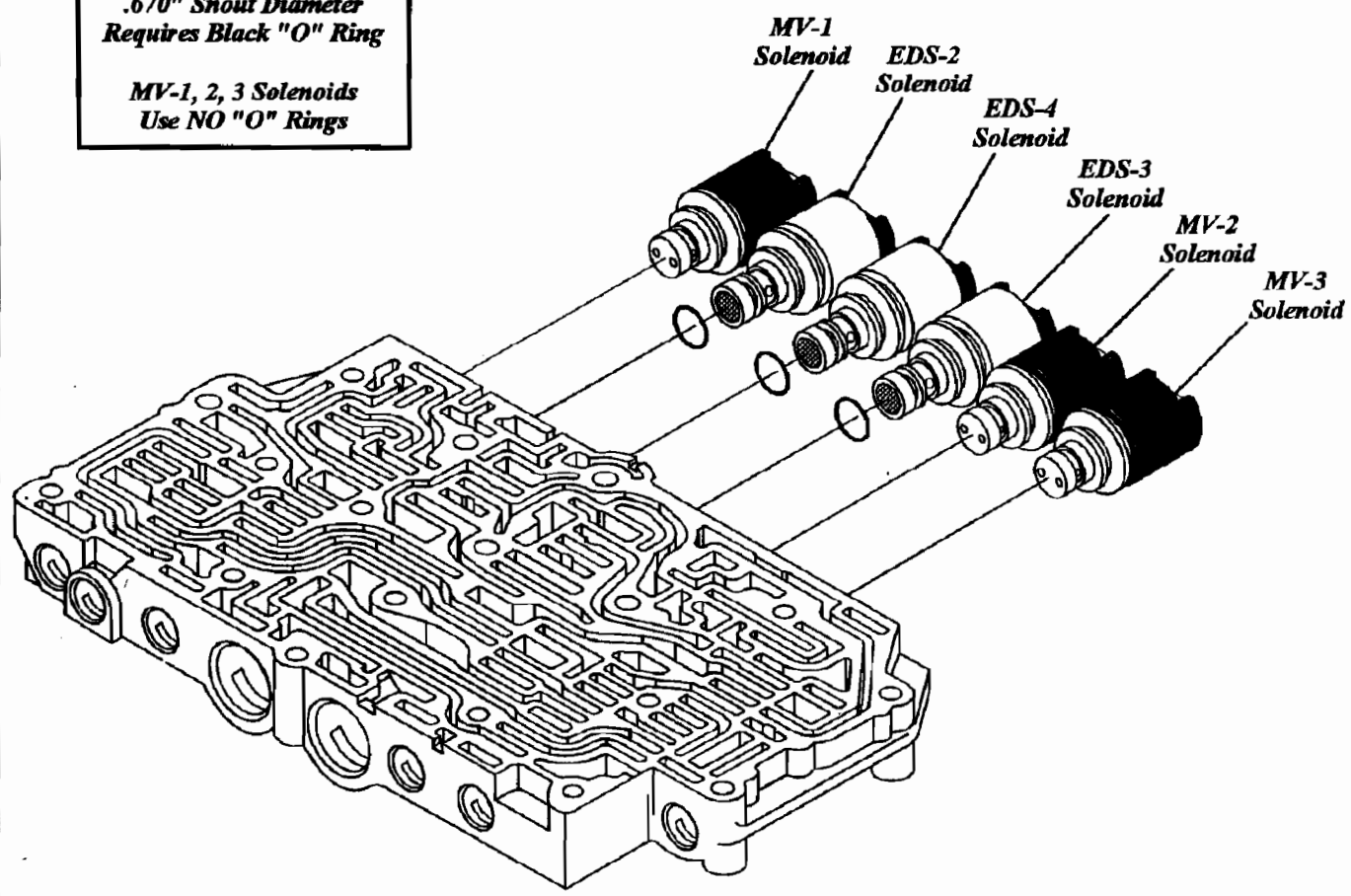
SPECIAL NOTE:

EDS-1 Solenoid
 .650" Snout Diameter
 Requires Green "O" Ring

EDS-2, 3, 4 Solenoids
 .670" Snout Diameter
 Requires Black "O" Ring

MV-1, 2, 3 Solenoids
 Use NO "O" Rings

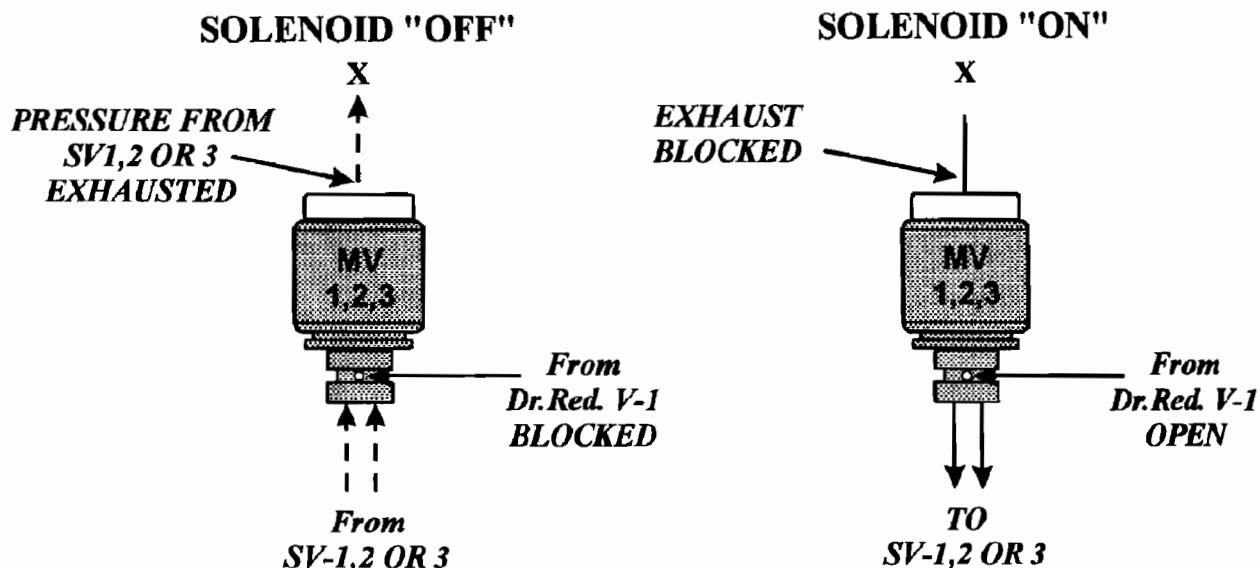
ZF Part Numbers	
EDS-1 Solenoid	0501 209 875
EDS-2, 3, 4, Solenoid	0501 208 562
MV-1, 2, 3, Solenoid	0501 313 506



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Figure 5

MV1, 2 AND 3 OPERATION

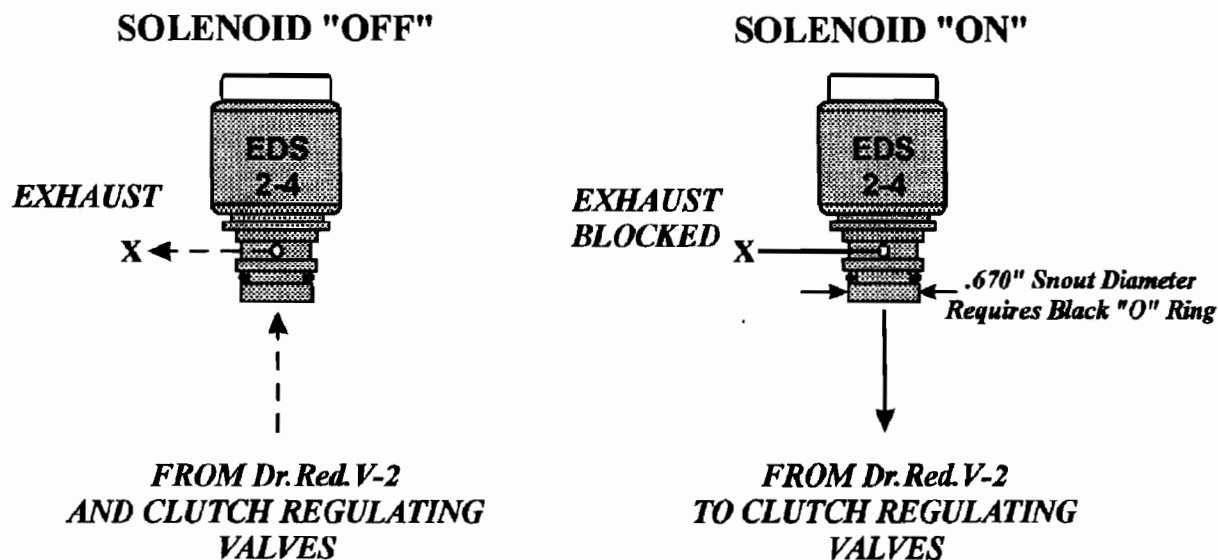


SUMMARY:

When MV 1, 2 or 3 is "OFF" Solenoid reducing pressure, from Dr. Red. V-1, is blocked by the solenoid and oil pressure from SV 1, 2 or 3 is exhausted at the rear of the solenoid.

When MV 1, 2 or 3 is "ON" Solenoid reducing pressure, From Dr.Red. V-1, is open through the solenoid and is applied to SV 1, 2 or 3. The exhaust at the rear of the solenoid

EDS 2, 3 AND 4 OPERATION



SUMMARY:

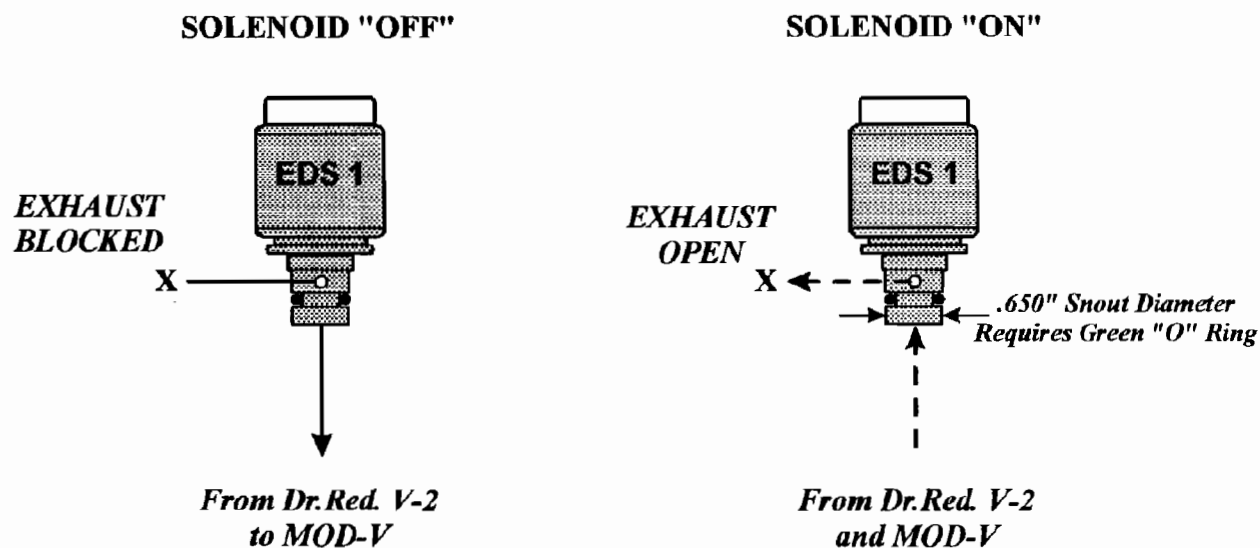
When EDS 2-5 solenoids are "OFF" they exhaust orificed solenoid reducing pressure, from Dr. Red. V-2, and the oil pressure from the clutch regulating valves releasing them.

When EDS 2-5 solenoids are "ON" the exhaust is blocked by the solenoid and solenoid reducing pressure, from Dr. Red. V-2, is applied to operate clutch regulating valves.

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Figure 6

EDS-1 OPERATION (Line Pressure Solenoid)



SUMMARY:

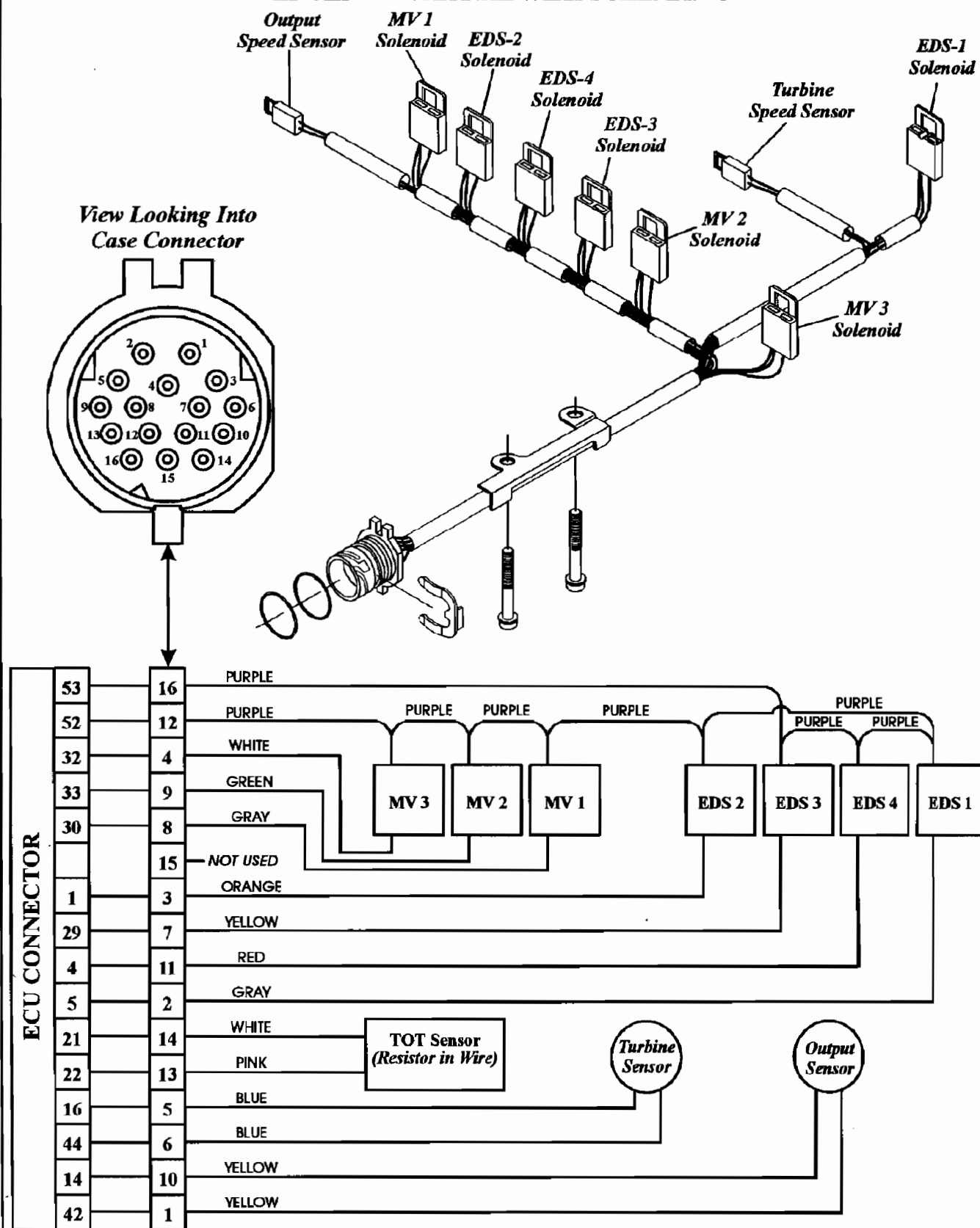
When EDS 1 solenoid is "OFF," solenoid reducing pressure, from Dr. Red. V-2, is high to MOD-V valve which creates high line pressure.

When EDS 1 solenoid is "ON," solenoid reducing pressure, from Dr. Red. V-2, is low to MOD-V valve which creates low line pressure.

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Figure 7

ZF-5HP-19 INTERNAL WIRE SCHEMATIC



NOTE: Some internal wire colors may vary.

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Figure 8

ZF-5HP-19 SOLENOID APPLICATION CHART

<i>Selector Lever Position</i>	<i>MV 1 Solenoid</i>	<i>MV 2 Solenoid</i>	<i>MV 3 Solenoid</i>	<i>EDS 1 Solenoid</i>	<i>EDS 2 Solenoid</i>	<i>EDS 3 Solenoid</i>	<i>EDS 4 Solenoid</i>	<i>GEAR RATIO</i>
PARK	ON			**				
REVERSE	ON		⊗	**		*		4.08:1
NEUTRAL	ON	ON		**		*		
D-1ST	ON	ON		**		*		3.66:1
D-2ND	ON	ON		**	*	*		1.99:1
D-3RD		ON		**	*		-*-	1.40:1
D-4TH				**			-*-	1.00:1
D-5TH			-*	**	*		-*-	0.74:1
Failsafe (4th)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1.00:1

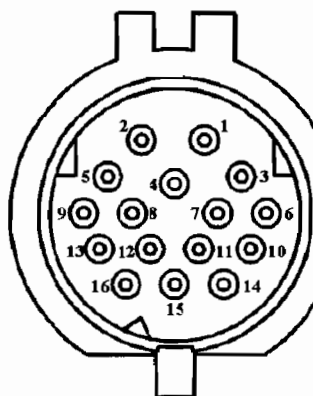
SOLENOID CHART LEGEND

<i>Symbol</i>	<i>Description</i>
ON	MV 1, MV 2 and MV 3 Solenoids are energized by the Electronic Transmission Control unit and have two functions. They are Open or Closed. Energized (On), there is pressure in circuit.
⊗	MV 3 is turned "ON" if reverse is selected at a high vehicle speed, to inhibit reverse engagement.
**	EDS 1 is used for line pressure control only, and operates from 0 to 0.8 amps. When the solenoid is "OFF" (0 amps), pressure is high. EDS 1 pressure is "Lowered" as the solenoid is modulated by the
*	EDS 2, EDS 3, and EDS 4 Solenoids are also pulse modulated but are exactly the opposite of EDS 1 Solenoid. When these solenoids are "ON" oil pressure in the hydraulic circuit is high, and when they are "OFF" pressure in the hydraulic circuit is low.
-*	Solenoid "OFF" (hydraulic pressure low), then Solenoid "ON" (hydraulic pressure high).
*-	Solenoid "ON" briefly (hydraulic pressure high), then Solenoid "OFF" (hydraulic pressure low). The pressure acts briefly on regulator valves to cushion clutch application.
-*-	EDS 4 Solenoid is used for Torque Converter Clutch apply and release only, and depends on throttle position and vehicle speed as to its application.

Figure 9

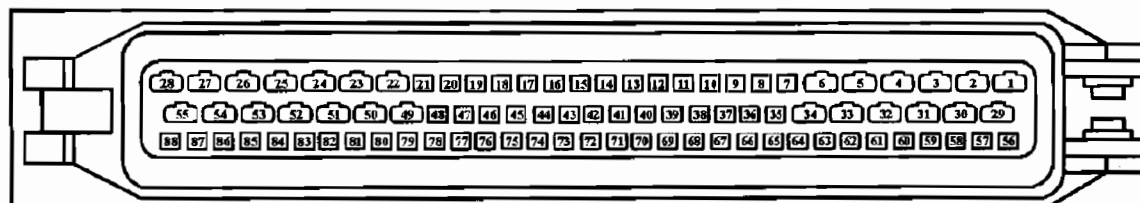
SOLENOID AND SENSOR RESISTANCE CHART

<i>Solenoid</i>	<i>Case Connector Pin Numbers - +</i>	<i>Control Unit Connector Pin Numbers - +</i>	<i>Resistance In Ohms</i>
MV 1	8 and 12	30 and 52	30 - 34 Ω
MV 2	9 and 12	33 and 52	30 - 34 Ω
MV 3	4 and 12	32 and 52	30 - 34 Ω
EDS 1	2 and 12	5 and 52	5.2 - 6.8 Ω
EDS 2	3 and 12	1 and 52	6.2 - 7.8 Ω
EDS 3	7 and 12	29 and 52	6.2 - 7.8 Ω
EDS 4	11 and 12	4 and 52	6.2 - 7.8 Ω
TOT	13 and 14	21 and 22	1000 Ω at 25° C
OSS	1 and 10	14 and 42	292 - 358 Ω
TSS	5 and 6	44 and 16	292 - 358 Ω



*View Looking Into
Case Connector*

Electronic Control Unit Connector Pin Identification



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Figure 10

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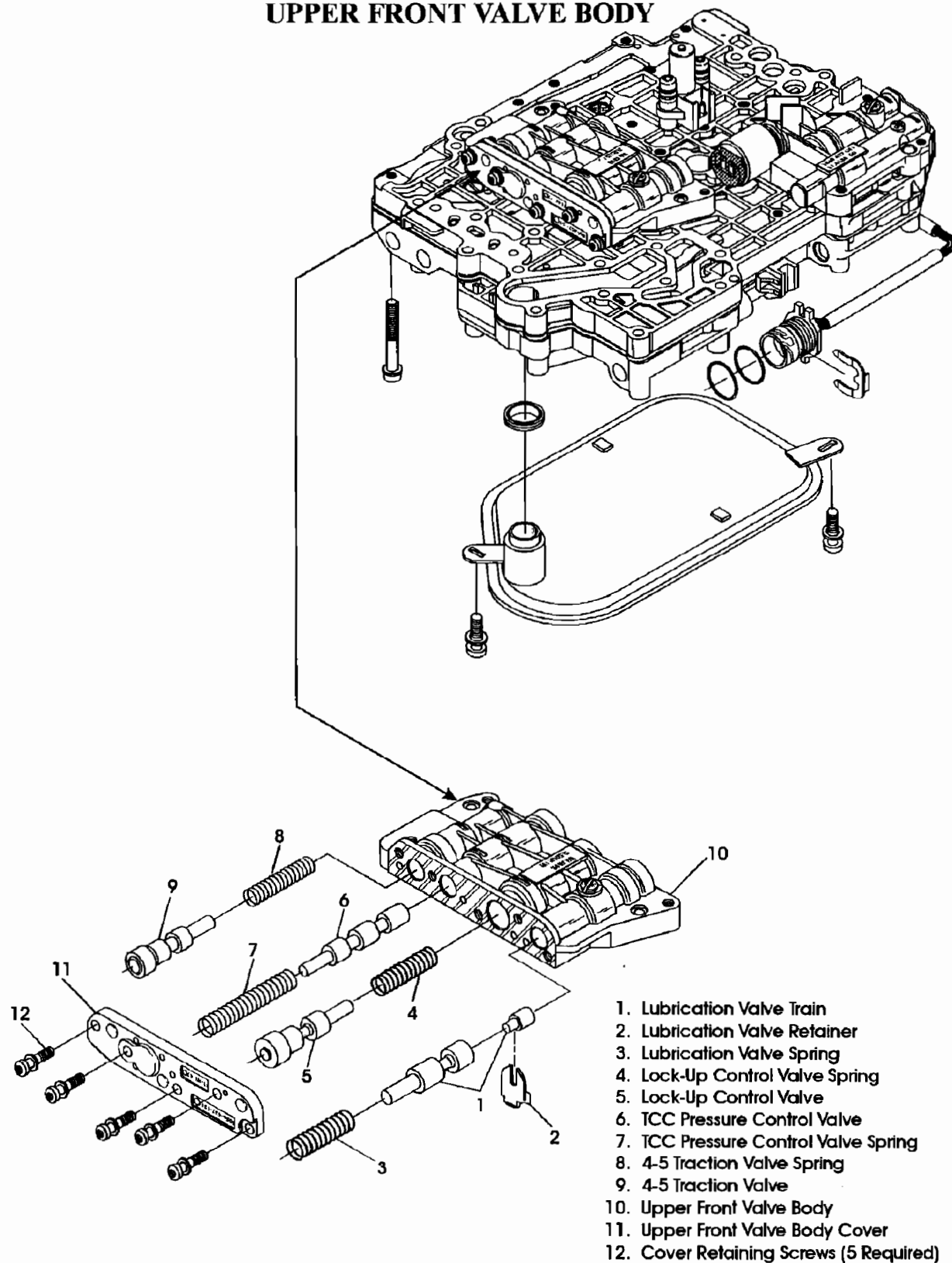
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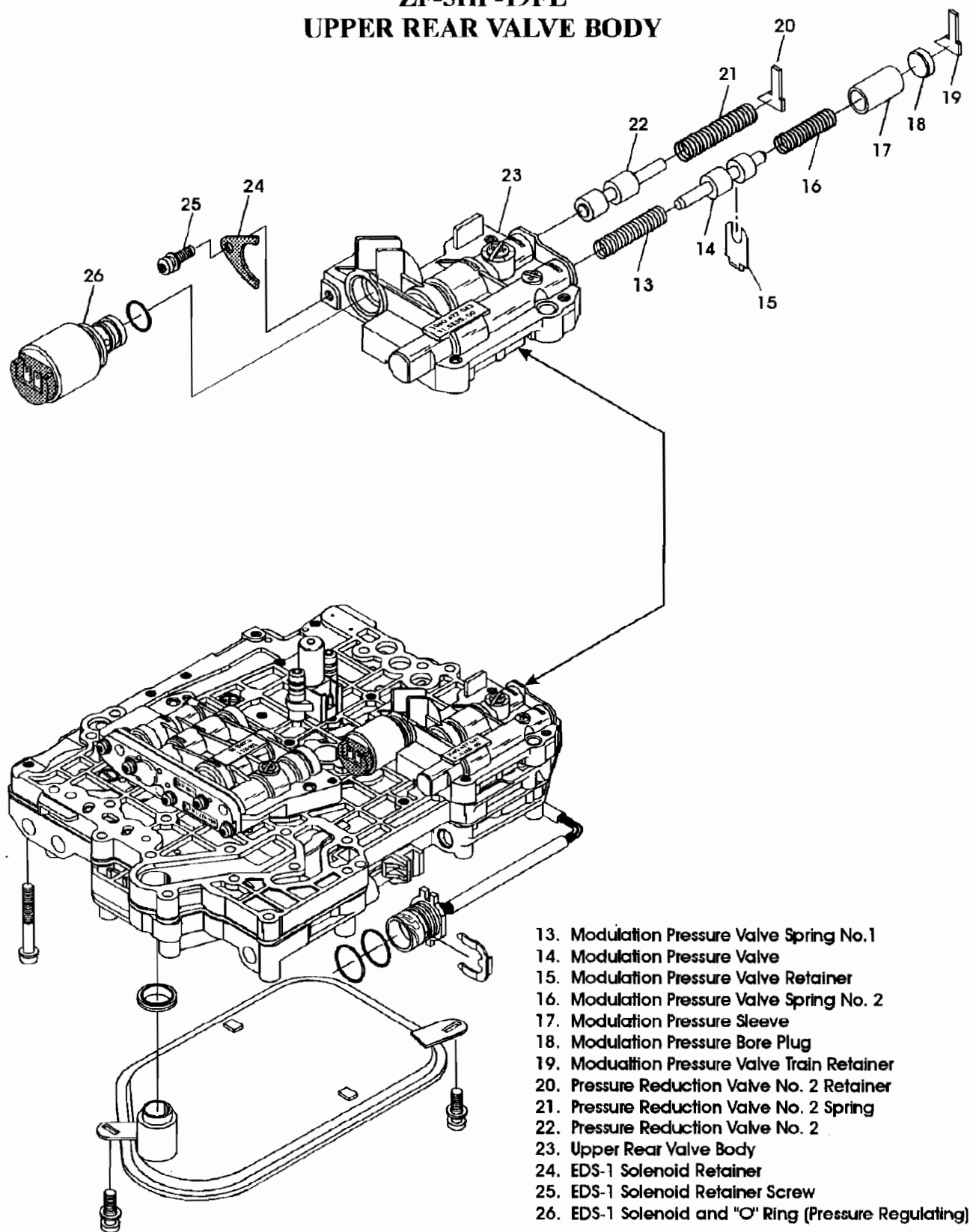
ZF-5HP-19FL UPPER FRONT VALVE BODY



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Figure 11

ZF-5HP-19FL UPPER REAR VALVE BODY

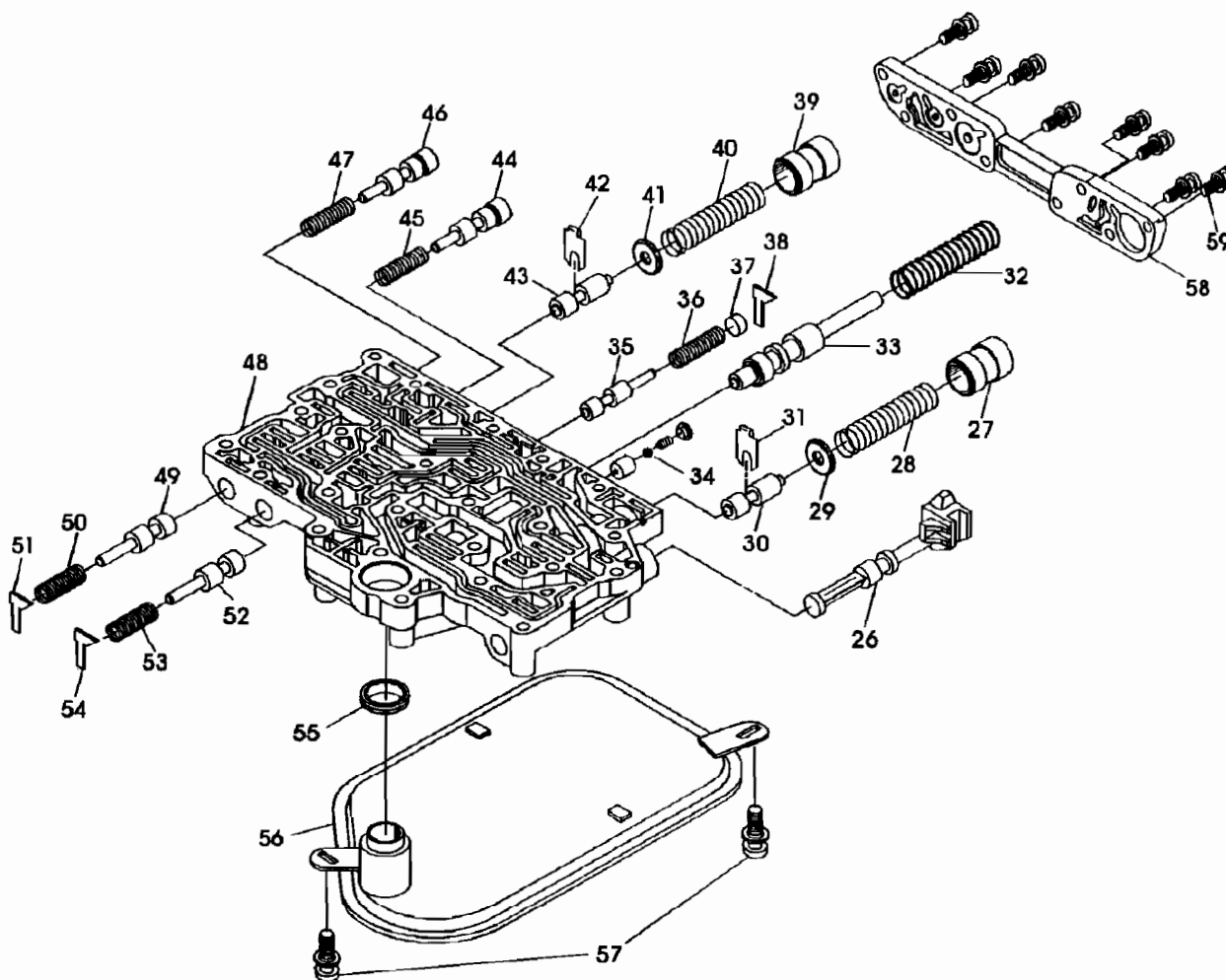


- 13. Modulation Pressure Valve Spring No.1
- 14. Modulation Pressure Valve
- 15. Modulation Pressure Valve Retainer
- 16. Modulation Pressure Valve Spring No. 2
- 17. Modulation Pressure Sleeve
- 18. Modulation Pressure Bore Plug
- 19. Modulation Pressure Valve Train Retainer
- 20. Pressure Reduction Valve No. 2 Retainer
- 21. Pressure Reduction Valve No. 2 Spring
- 22. Pressure Reduction Valve No. 2
- 23. Upper Rear Valve Body
- 24. EDS-1 Solenoid Retainer
- 25. EDS-1 Solenoid Retainer Screw
- 26. EDS-1 Solenoid and "O" Ring (Pressure Regulating)

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Figure 12

ZF-5HP-19FL LOWER FRONT VALVE BODY

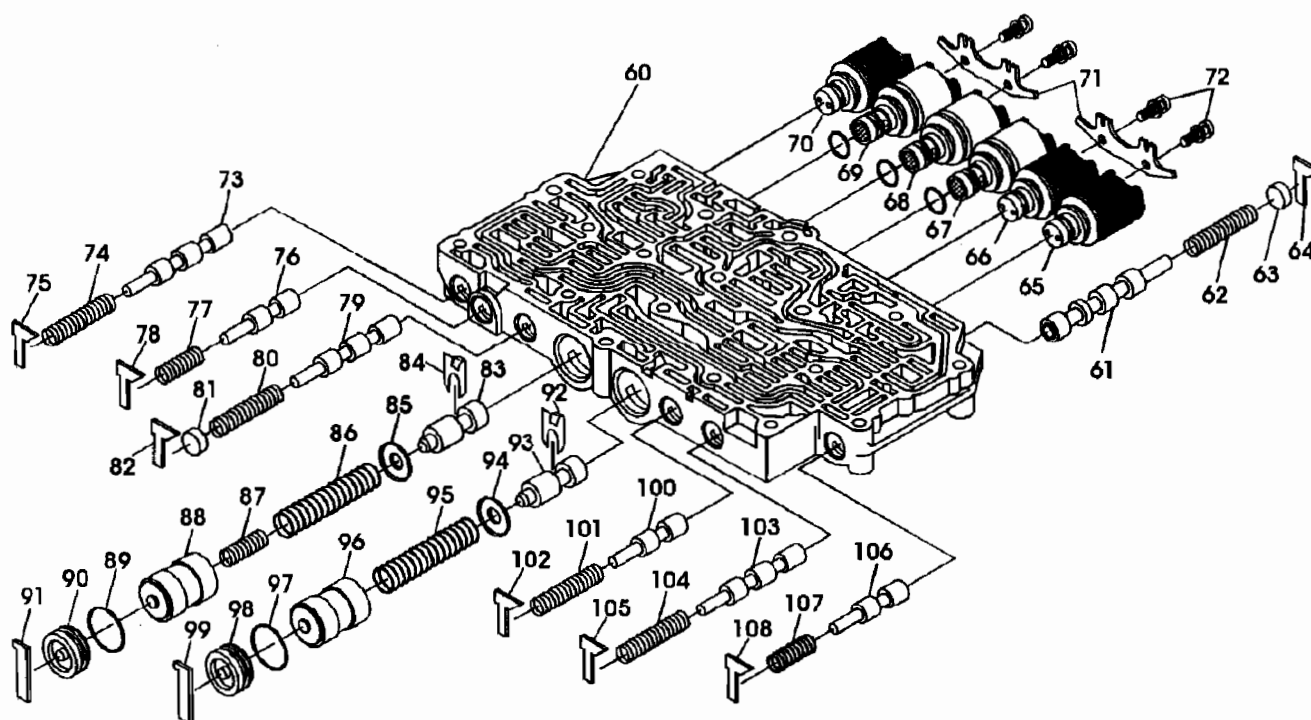


- | | |
|-----------------------------------------------------|---------------------------------------------------|
| 26. Manual Shift Valve (W-S) | 43. "A" Clutch Accumulator Regulator Valve |
| 27. "E" Clutch Damper Valve | 44. "G" Clutch Accumulator Regulator Valve |
| 28. "E" Clutch Damper Valve Spring | 45. "G" Clutch Accumulator Regulator Valve Spring |
| 29. "E" Clutch Damper Valve Spring Seat | 46. "C" Clutch Accumulator Regulator Valve |
| 30. "E" Clutch Accumulator Regulator Valve | 47. "C" Clutch Accumulator Regulator Valve Spring |
| 31. "E" Clutch Accumulator Regulator Valve Retainer | 48. Lower Front Valve Body |
| 32. Main Pressure Regulator Valve Spring | 49. "C" Clutch Shift Valve |
| 33. Main Pressure Regulator Valve | 50. "C" Clutch Shift Valve Spring |
| 34. "D" Clutch One-Way Check Valve Assembly | 51. "C" Clutch Shift Valve Retainer |
| 35. 5-4 Traction Valve | 52. "G" Clutch Shift Valve |
| 36. 5-4 Traction Valve Spring | 53. "G" Clutch Shift Valve Spring |
| 37. 5-4 Traction Valve Bore Plug | 54. "G" Clutch Shift Valve Retainer |
| 38. 5-4 Traction Valve Train Retainer | 55. Filter Seal |
| 39. "A" Clutch Damper Valve | 56. Oil Filter |
| 40. "A" Clutch Damper Valve Spring | 57. Oil Filter Retaining Screws |
| 41. "A" Clutch Damper Valve Spring Seat | 58. Lower Valve Body Cover |
| 42. "A" Clutch Accumulator Regulator Valve Retainer | 59. Lower Valve Body Cover Screws (8 Required) |

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Figure 13

ZF-5HP-19FL LOWER REAR VALVE BODY



- 60. Lower Rear Valve Body
- 61. Number 1 Shift Valve
- 62. Number 1 Shift Valve Spring
- 63. Number 1 Shift Valve Bore Plug
- 64. Number 1 Shift Valve Retainer
- 65. MV-3 Solenoid (On-Off)
- 66. MV-2 Solenoid (On-Off)
- 67. EDS-3 Solenoid and "O" Ring (Pressure Regulating)
- 68. EDS-4 Solenoid and "O" Ring (Pressure Regulating)
- 69. EDS-2 Solenoid and "O" Ring (Pressure Regulating)
- 70. MV-1 Solenoid (On-Off)
- 71. Solenoid Retaining Brackets (2 Required)
- 72. Solenoid Retaining Bracket Screws (4 Required)
- 73. Traction Coast Valve
- 74. Traction Coast Valve Spring
- 75. Traction Coast Valve Train Retainer
- 76. ICC Release Regulator Valve
- 77. ICC Release Regulator Valve Spring
- 78. ICC Release Regulator Valve Train Retainer
- 79. Number 3 Shift Valve
- 80. Number 3 Shift Valve Spring
- 81. Number 3 Shift Valve Train Bore Plug
- 82. Number 3 Shift Valve Train Retainer
- 83. "D" Clutch Accumulator Regulator Valve
- 84. "D" Clutch Accumulator Regulator Valve Retainer

- 85. "D" Clutch Damper Valve Spring Seat
- 86. "D" Clutch Damper Valve Outer Spring
- 87. "D" Clutch Damper Valve Inner Spring
- 88. "D" Clutch Damper Valve
- 89. "D" Clutch Valve Train Bore Plug "O" Ring
- 90. "D" Clutch Valve Train Bore Plug
- 91. "D" Clutch Valve Train Bore Plug Retainer
- 92. "F" Clutch Accumulator Regulator Valve Retainer
- 93. "F" Clutch Accumulator Regulator Valve
- 94. "F" Clutch Damper Valve Spring Seat
- 95. "F" Clutch Damper Valve Spring
- 96. "F" Clutch Damper Valve
- 97. "F" Clutch Valve Train Bore Plug "O" Ring
- 98. "F" Clutch Valve Train Bore Plug
- 99. "F" Clutch Valve Train Bore Plug Retainer
- 100. Reverse Gear Valve
- 101. Reverse Gear Valve Spring
- 102. Reverse Gear Valve Train Retainer
- 103. Number 2 Shift Valve
- 104. Number 2 Shift Valve Spring
- 105. Number 2 Shift Valve Train Retainer
- 106. Pressure Reduction Valve
- 107. Pressure Reduction Valve Spring
- 108. Pressure Reduction Valve Train Retainer

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Figure 14

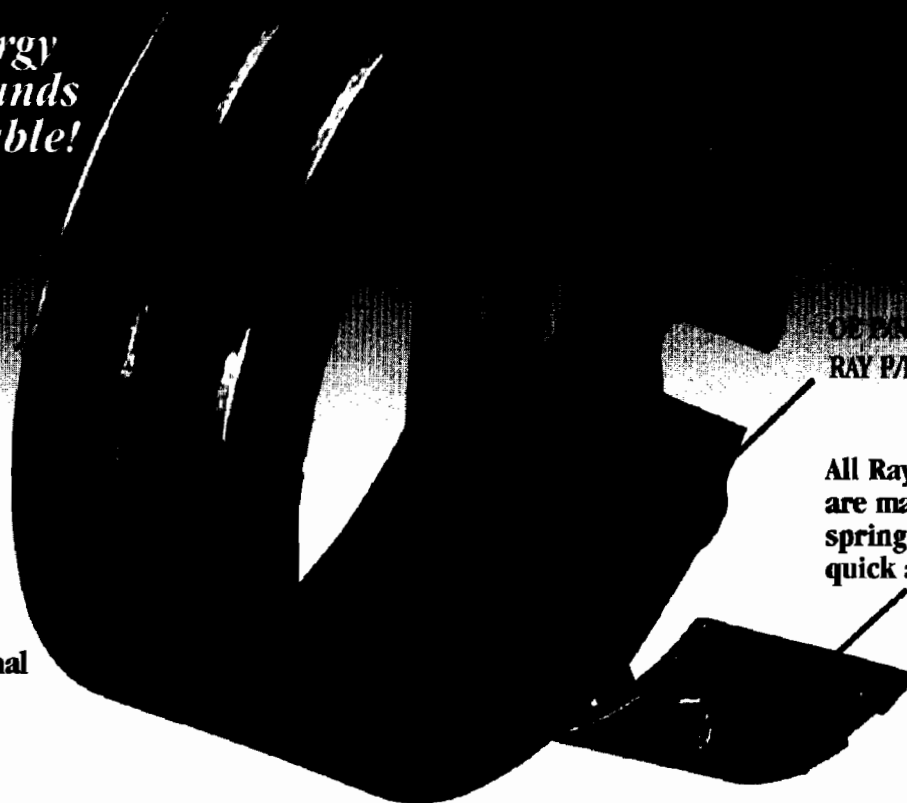
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Although the basic concept of how the transmission band functions is still relatively simple, Raybestos continually strives to provide the OEM and aftermarket with improved transmission product designs and materials.

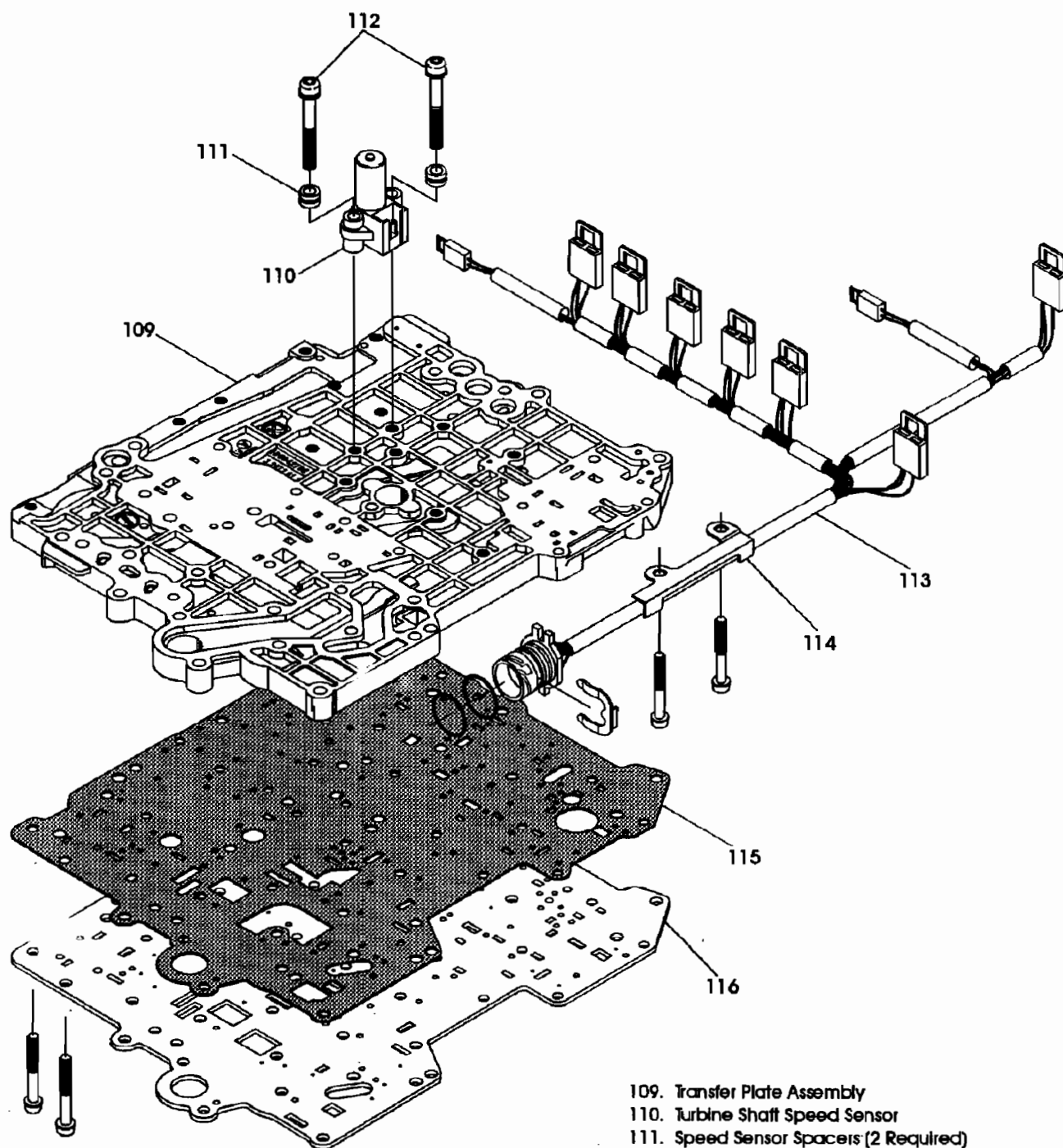
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ZF-5HP-19FL TRANSFER PLATE, SPACER PLATE, AND TURBINE SPEED SENSOR

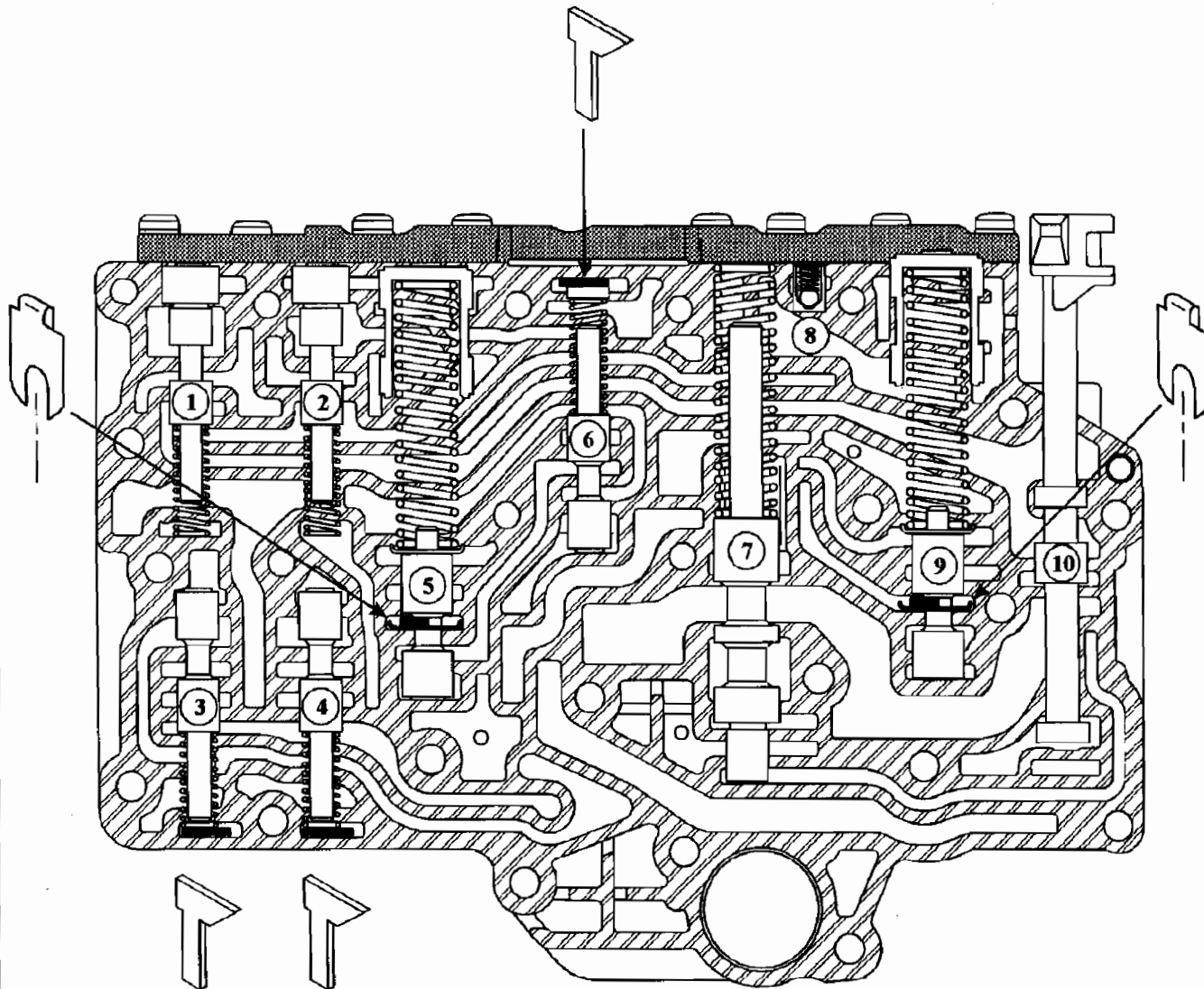


- 109. Transfer Plate Assembly
- 110. Turbine Shaft Speed Sensor
- 111. Speed Sensor Spacers (2 Required)
- 112. Speed Sensor Retaining Bolts (2 Required)
- 113. Internal Wiring Harness Assembly
- 114. Internal Wire Harness Retaining Bracket
- 115. Spacer Plate To Transfer Plate Gasket
- 116. Valve Body Spacer Plate

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Figure 15

ZF-5HP-19FL LOWER FRONT VALVE BODY

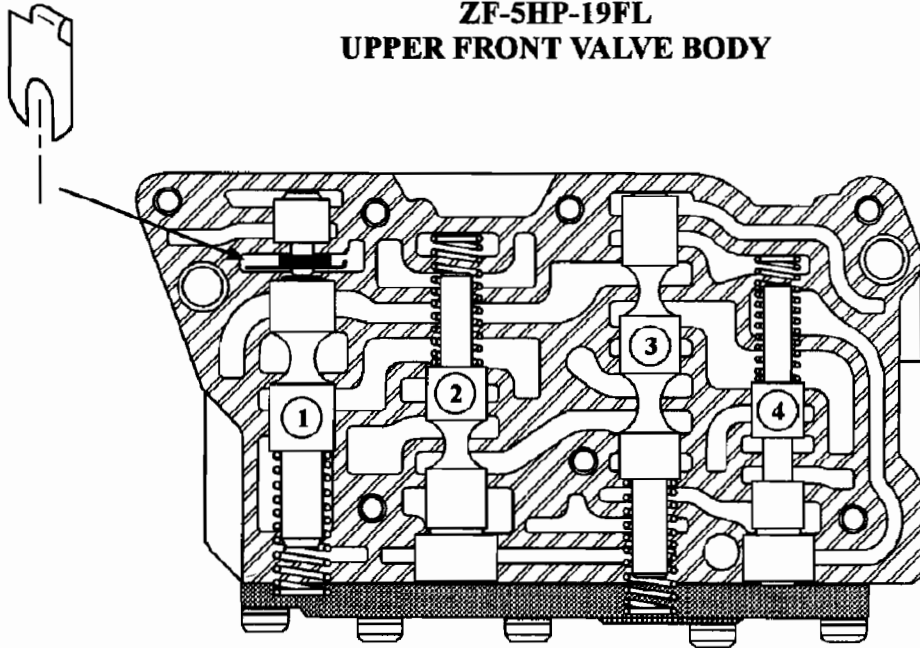


1. "C" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
2. "G" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
3. "C" CLUTCH SHIFT VALVE TRAIN LINE-UP.
4. "G" CLUTCH SHIFT VALVE TRAIN LINE-UP.
5. "A" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
6. 5-4 TRACTION VALVE TRAIN LINE-UP.
7. MAIN PRESSURE REGULATOR VALVE TRAIN LINE-UP.
8. "D" CLUTCH ONE-WAY CHECK VALVE ASSEMBLY.
9. "E" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
10. MANUAL SELECTOR SHIFT VALVE.

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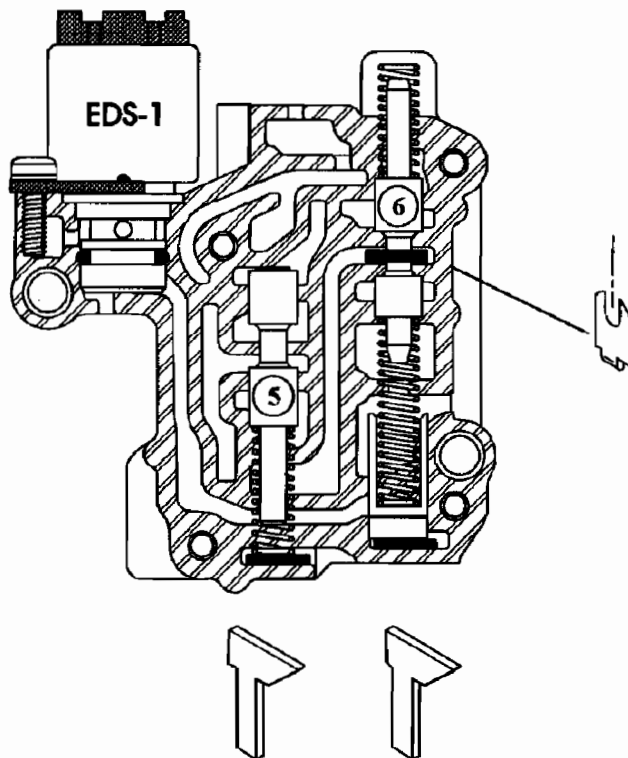
Figure 16

ZF-5HP-19FL UPPER FRONT VALVE BODY



1. LUBRICATION VALVE TRAIN LINE-UP.
2. LOCK-UP CONTROL VALVE TRAIN LINE-UP.
3. LOCK-UP PRESSURE CONTROL VALVE LINE-UP.
4. 4-5 TRACTION VALVE TRAIN LINE-UP.

ZF-5HP-19FL UPPER REAR VALVE BODY

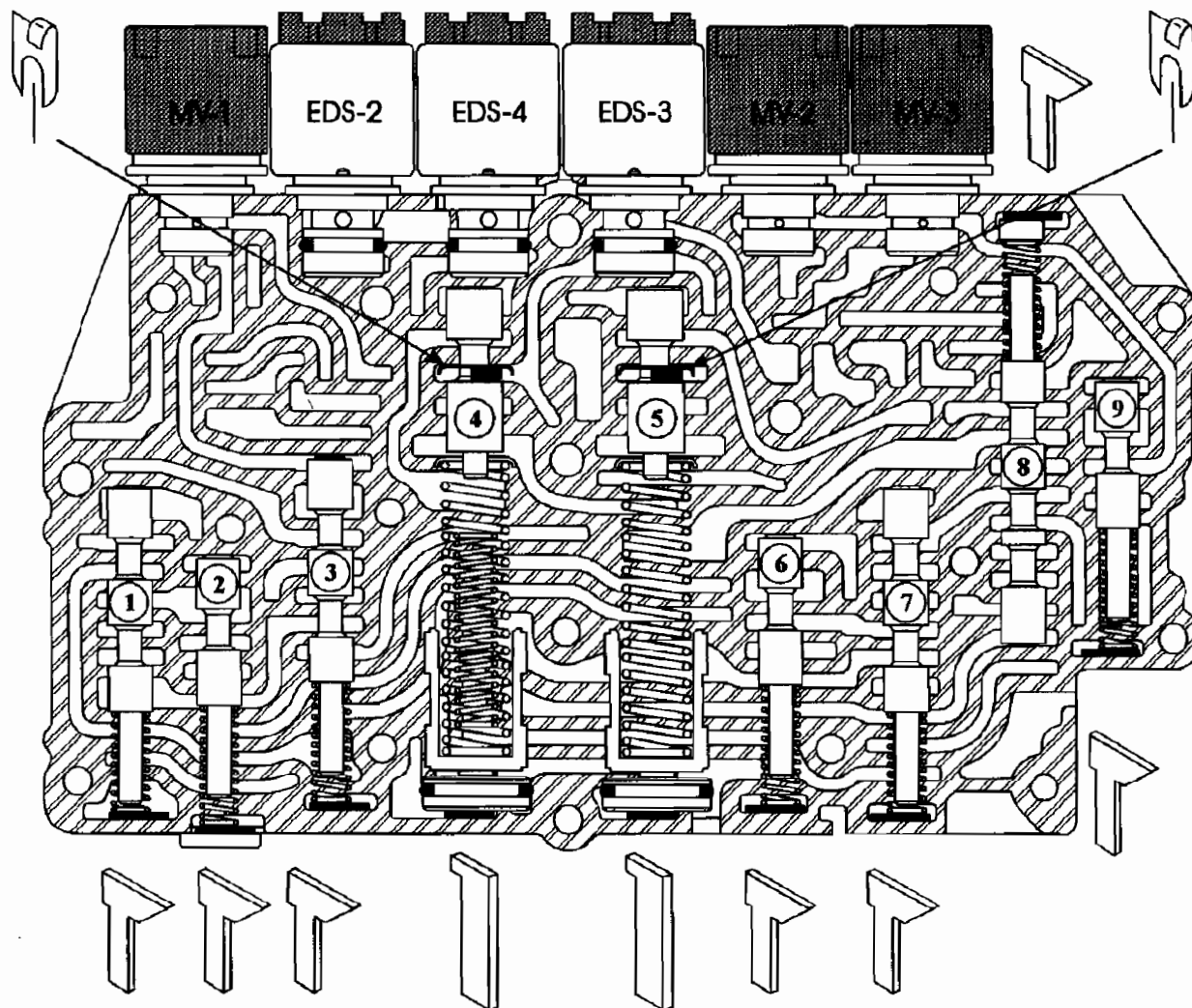


5. MODULATION PRESSURE VALVE TRAIN LINE-UP.
6. PRESSURE REDUCTION VALVE NUMBER TWO LINE-UP.

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Figure 17

ZF-5HP-19FL LOWER REAR VALVE BODY



1. TRACTION COAST VALVE TRAIN LINE-UP.
2. TCC RELEASE REGULATOR VALVE TRAIN LINE-UP.
3. NUMBER 3 SHIFT VALVE TRAIN LINE-UP.
4. "D" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
5. "F" CLUTCH ACCUMULATOR REGULATOR VALVE TRAIN LINE-UP.
6. REVERSE GEAR VALVE TRAIN LINE-UP.
7. NUMBER 2 SHIFT VALVE TRAIN LINE-UP.
8. NUMBER 1 SHIFT VALVE TRAIN LINE-UP.
9. PRESSURE REDUCTION VALVE TRAIN LINE-UP.

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Figure 18

ZF-5HP-19FL CHANNEL PLATE LOCATIONS

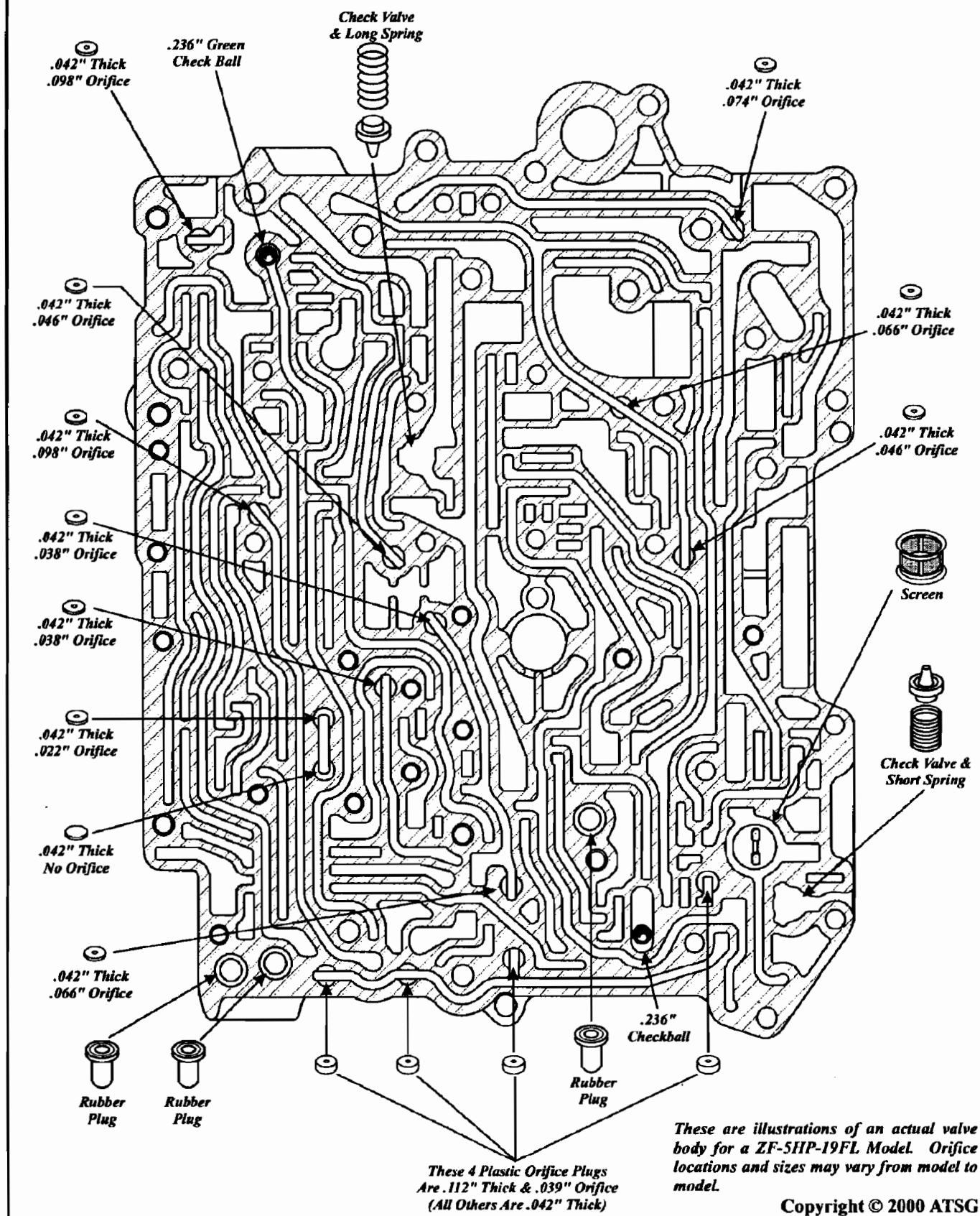


Figure 19



BMW ZF 5-HP-30

NO REVERSE & A 3-NEUTRAL SHIFT

COMPLAINT: 1991 and later BMW vehicles equipped with the ZF5HP30 transmission may exhibit a no reverse condition, when selector lever is placed in the reverse position. This condition usually occurs after overhaul.

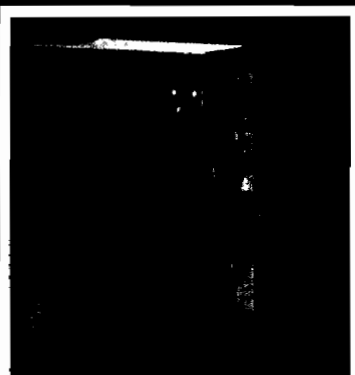
CAUSE: This condition can be caused by the incorrect assembly of the "A"/"C" Clutch Housing. If the clutch housing has been severely damaged, aluminum material will be evidenced in the bottom pan upon inspection.
When the unit is removed and the "A"/"C" Clutch Housing is dis-assembled, it is not uncommon for the unit to set for over a week waiting on parts. When re-assembling it is very easy to *mis-assemble* the "B" Clutch Hub (Figure 1, Item 8) on top of the retaining snap ring for the "A" Clutch pack (Figure 1, Item 10). This mis-assembly will create a neutralizing on the 3-4 upshift, and the Trans light will begin flashing.

CORRECTION: *Ensure that you assemble the "B" Clutch Hub on top of the "A" Clutch stack, and then install the "A" Clutch Pressure Plate and snap ring, as shown in Figure 2.*

TRANSMISSION TESTING

A TO Z

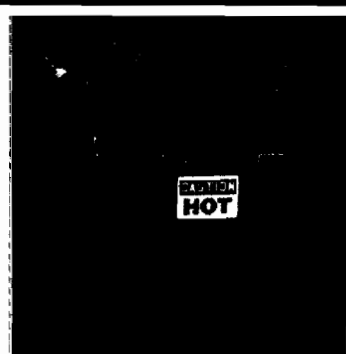
Industry leaders . . . combined technology . . . leading products



ANSWERMATIC

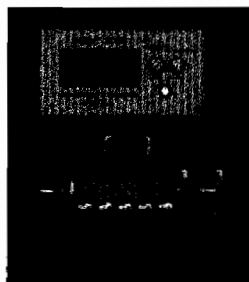
AMI

Delivers ATF under pressure enabling builder to completely test transmissions with the valve body removed in or out of the vehicle! Test plates available for 85 different transmissions.



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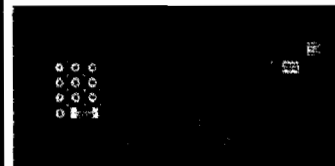
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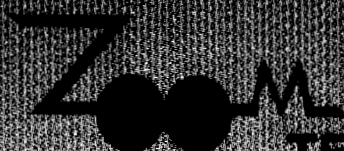
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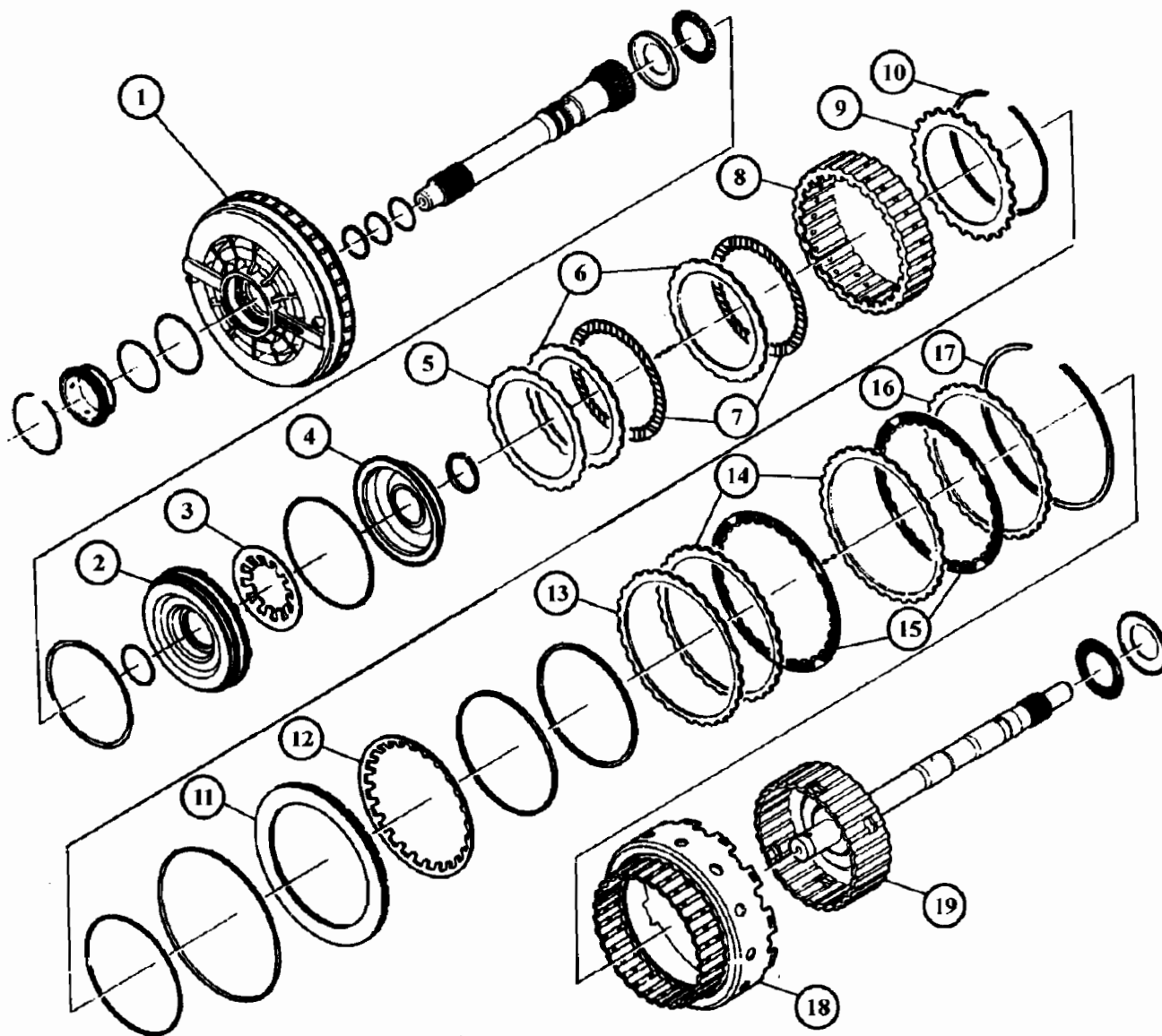
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BMW ZF 5-HP-30
NO REVERSE & A 3-NEUTRAL SHIFT

"A"/"C" CLUTCH HOUSING COMPONENTS



1. "A"/"C" Clutch Housing Assembly
2. "A" Clutch Apply Piston
3. "A" Clutch Bellville Return Spring
4. "A" Clutch Piston Oil Dam
5. "A" Clutch Cushion Plate
6. "A" Clutch Steel Plates (5 Required)
7. "A" Clutch Friction Plates (5 Required)
8. "B" Clutch Hub
9. "A" Clutch Pressure Plate
10. "A" Clutch Pressure Plate Snap Ring

11. "C" Clutch Apply Piston
12. "C" Clutch Apply Piston Return Spring
13. "C" Clutch Cushion Plate
14. "C" Clutch Steel Plates (3 Required)
15. "C" Clutch Friction Plates (3 Required)
16. "C" Clutch Pressure Plate
17. "C" Clutch Pressure Plate Snap Ring
18. "C" Clutch Hub
19. "A" Clutch Hub And Input Shaft

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Figure 1

BMW ZF 5-HP-30
NO REVERSE & A 3-NEUTRAL SHIFT

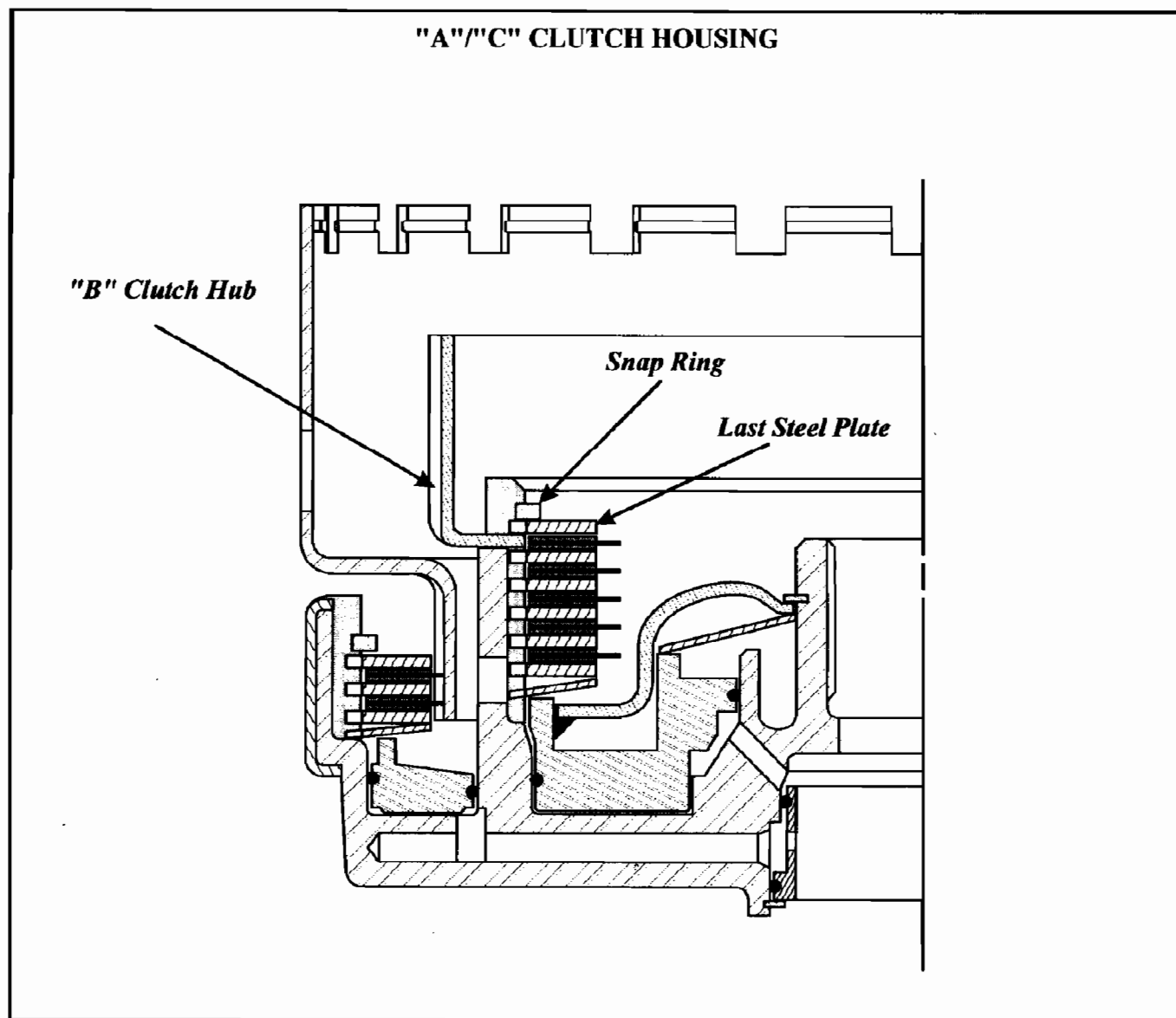


Figure 2

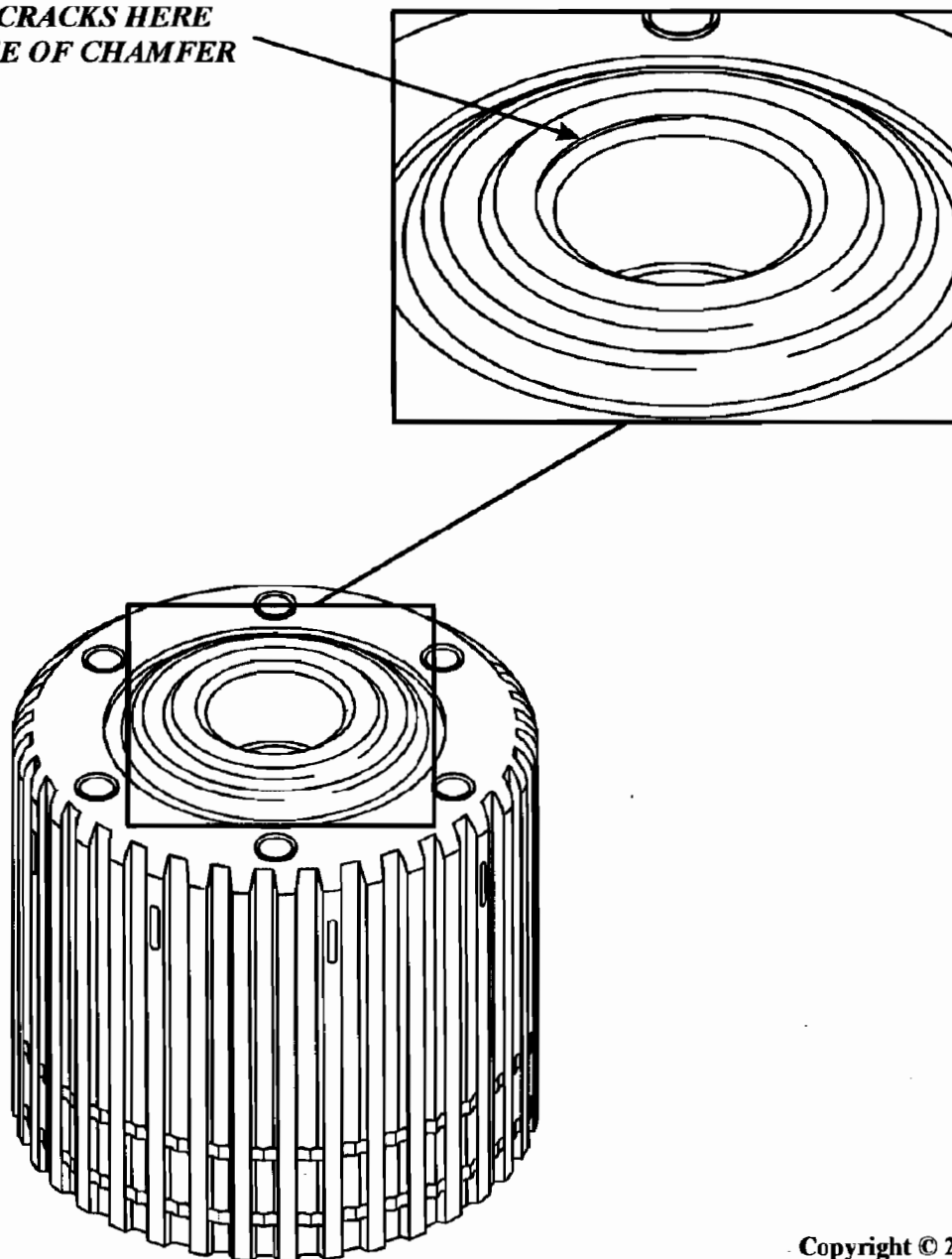
THM 4L30-E SLIPPING OR NO 2ND GEAR

COMPLAINT: Before and/or after overhaul, the vehicle exhibits a slipping condition when going into second gear, or possibly no second gear at all.

CAUSE: The cause may be, a cracked 2nd clutch housing that is barely perceptible, as shown in Figure 1.

CORRECTION: Replace the 2nd clutch housing as necessary. Refer to Figure 1.

**HOUSING CRACKS HERE
AT TOP EDGE OF CHAMFER**



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Figure 1

PROBLEMS WITH A UNIT IN YOUR SHOP?



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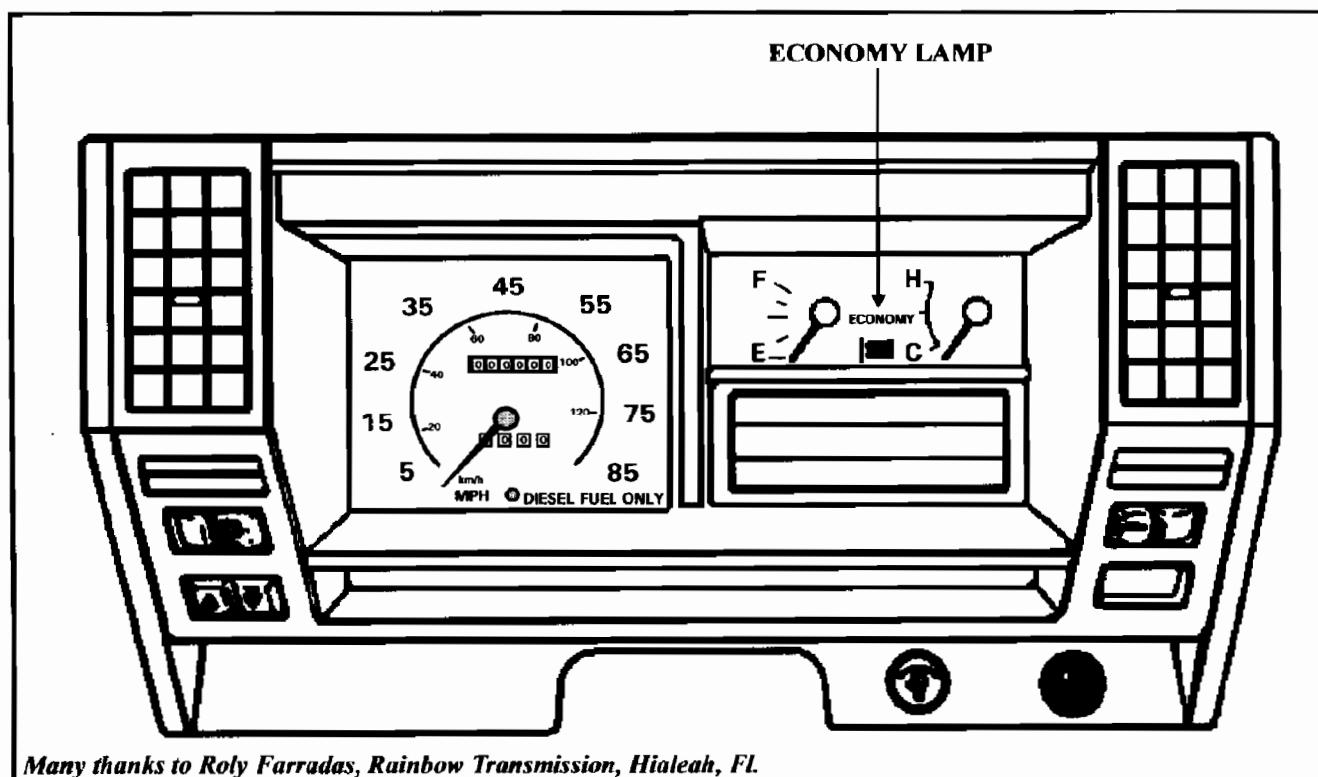


The World Series of Technical Seminars

ISUZU NPR/GMC FORWARD TILTMASTER CODE RETRIEVAL

1988-95 MODELS

The 1988-95 models use an **ECONOMY Indicator Lamp** that will flash continuously when the ignition is on and the Automatic Transmission Control Unit (ATCU) senses a fault in the transmission control system. (Refer to Figure 1)



Many thanks to Roly Farradas, Rainbow Transmission, Hialeah, FL.

Figure 1

Although the 1988-95 trucks use the ECONOMY Indicator Lamp to display codes that are stored, the method of code retrieval and code pattern varies between model years.

1988-90 MODELS

If no codes are stored, the Economy Indicator Lamp will come ON for 2 seconds and then go OUT. If when the code retrieval procedure is done but there are no codes stored, the Economy Indicator Lamp will flash continuously.

The code retrieval method for **1988-90** models is shown in figure 2.

1988-90 CODE RETRIEVAL PROCEDURE

1. Ignition "OFF"
2. Shift lever in "D" range
3. Economy switch in "NORMAL" position
4. Ignition switch "ON"
5. Shift lever in "2" range
6. Economy switch in ECONOMY position
7. Shift lever in "1" range
8. Economy switch in "NORMAL" position
9. Depress accelerator pedal to the floor and release

Figure 2

ISUZU NPR/GMC FORWARD TILTMASTER CODE RETRIEVAL 1988-95 MODELS

The ECONOMY Indicator Lamp will flash a judgement flash that will have remained on **LONGER** than the other flashes as indicated in figure 3, **the LONGER flash is the judgement code.**

The 1988-90 trucks have a code retrieval procedure and code display much like a Nissan car.

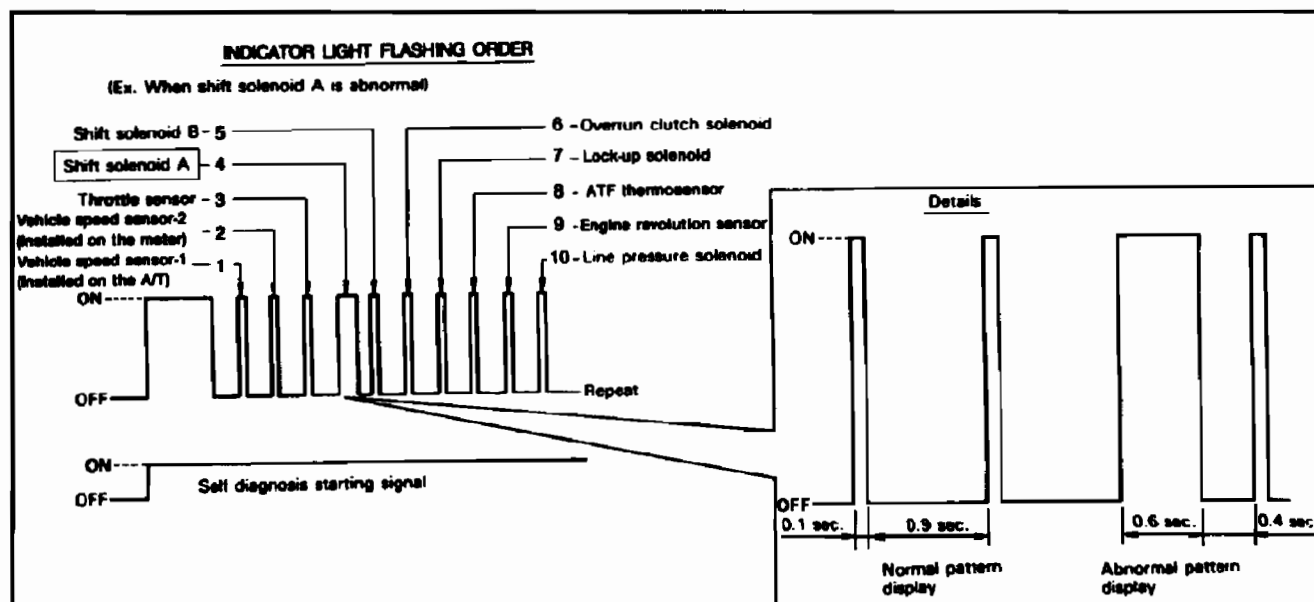


Figure 3

The code chart is listed in figure 4 is for the 1988-90 trucks and indicates the judgement flash codes the ATCU is capable of storing. If the ECONOMY Indicator Lamp does **NOT** respond, check operation of the Inhibitor Switch, Economy Switch & Bulb, Kickdown Switch or the Idle Switch.

Codes can be cleared by removing the #11 fuse from the glove box fuse box. (See Figure 8)

1988-90 CODE CHART		
JUDGEMENT CODE	COMPONENT AFFECTED	PROBABLE CAUSE
1	SPEED SENSOR #1	SPEED SENSOR ON TRANSMISSION FAULT
2	SPEED SENSOR #2	SPEED SENSOR IN SPEEDOMETER FAULT
3	THROTTLE SENSOR	OUT OF RANGE
4	SHIFT SOLENOID "A"	OPEN OR SHORTED
5	SHIFT SOLENOID "B"	OPEN OR SHORTED
6	OVERRUN CLUTCH SOLENOID	OPEN OR SHORTED
7	LOCK-UP SOLENOID	OPEN OR SHORTED
8	ATF THERMOSENSOR	ATF TEMP SENSOR FAULT
9	ENGINE RPM SENSOR	OPEN CIRCUIT
10	LINE PRESSURE SOLENOID	OPEN OR SHORTED

Figure 4

ISUZU NPR/GMC FORWARD TILTMASTER CODE RETRIEVAL 1991 MODELS

For 1991 the Economy indicator lamp still flashes continuously when a code is stored by the ATCU. The 1991 model year code retrieval procedure changed to a diagnostic connector that is jumped which will cause the Economy Indicator Lamp to flash the codes, the **TWO WIRE** diagnostic connector is located behind the glove box, next to the ATCU as shown in figure 5.

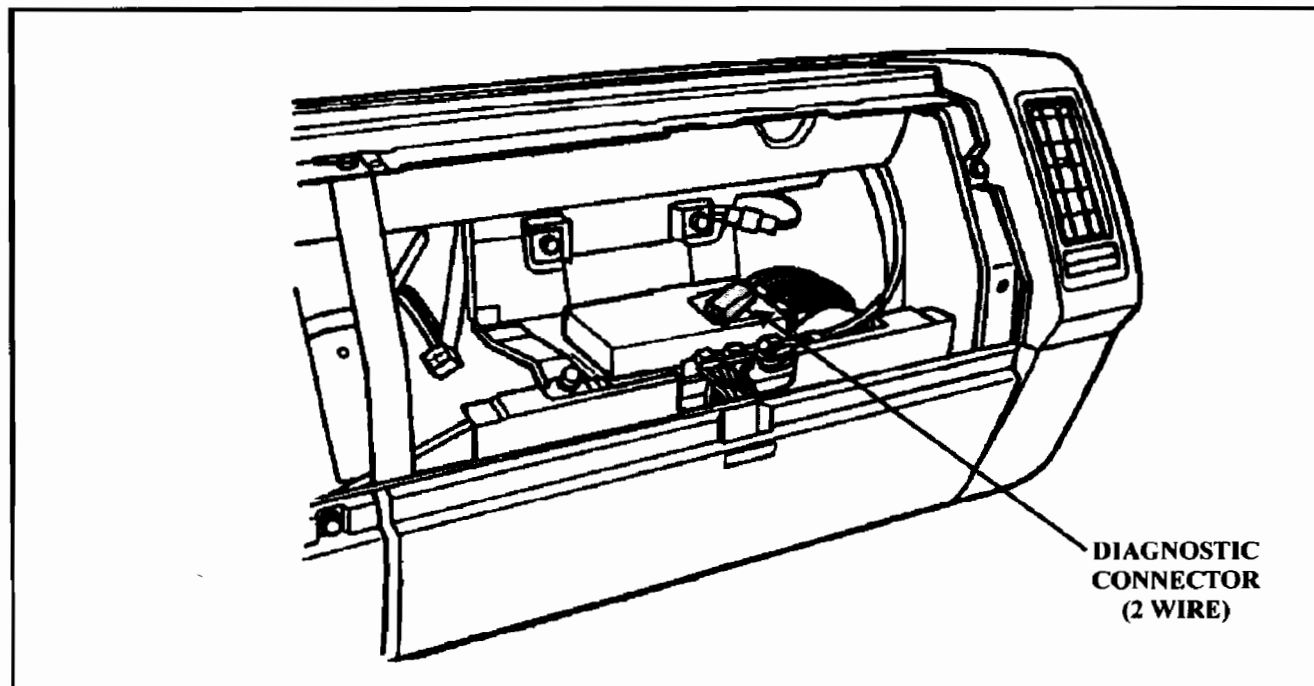


Figure 5

The code pattern also changed which resembles the typical GM code format. The first digit are LONG flashes, and the second digit are SHORT flashes as seen in the illustration in figure 6. If no codes are stored, the Economy Indicator Lamp will come on for two seconds when the ignition is turned ON, and then go out.

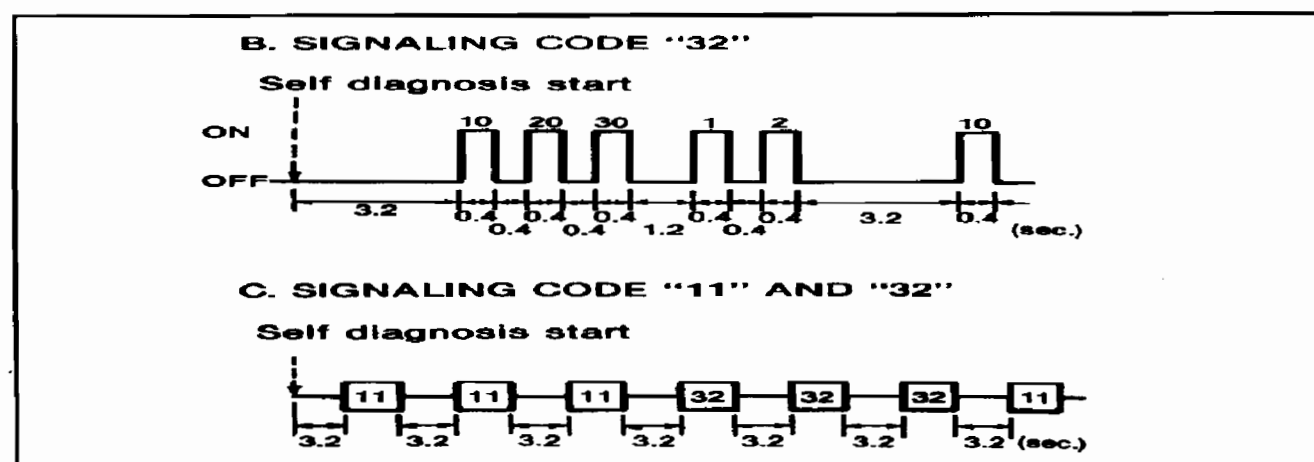


Figure 6

ISUZU NPR/GMC FORWARD TILTMASTER CODE RETRIEVAL

1991 MODELS

If no codes are stored after the code retrieval procedure is performed, a code "1" will be flashed repeatedly. If one code is stored, the code will be repeated three times.

When two or more codes are stored, each code will be repeated three times with each code displayed in numerical order.

The code chart for 1991 trucks is illustrated in figure 7.

1991 CODE CHART		
CODE NUMBER	COMPONENT AFFECTED	PROBABLE CAUSE
11	SPEED SENSOR #1	SPEED SENSOR ON TRANSMISSION FAULT
24	SPEED SENSOR #2	SPEED SENSOR IN SPEEDOMETER FAULT
13	ENGINE RPM SENSOR	OPEN OR SHORTED
15	ATF THERMOSENSOR	OPEN OR SHORTED
21	THROTTLE SENSOR	OPEN OR SHORTED
31	SHIFT SOLENOID "A"	OPEN OR SHORTED
32	SHIFT SOLENOID "B"	OPEN OR SHORTED
33	OVERRUN CLUTCH SOLENOID	OPEN OR SHORTED
34	LOCK-UP SOLENOID	OPEN OR SHORTED
35	LINE PRESSURE SOLENOID	OPEN OR SHORTED

Figure 7

Codes can be cleared by removing the #11 fuse from the glove box fuse box as shown in figure 8.

NOTE: On Budget rental trucks, remove **CIRCUIT BREAKER #8**.

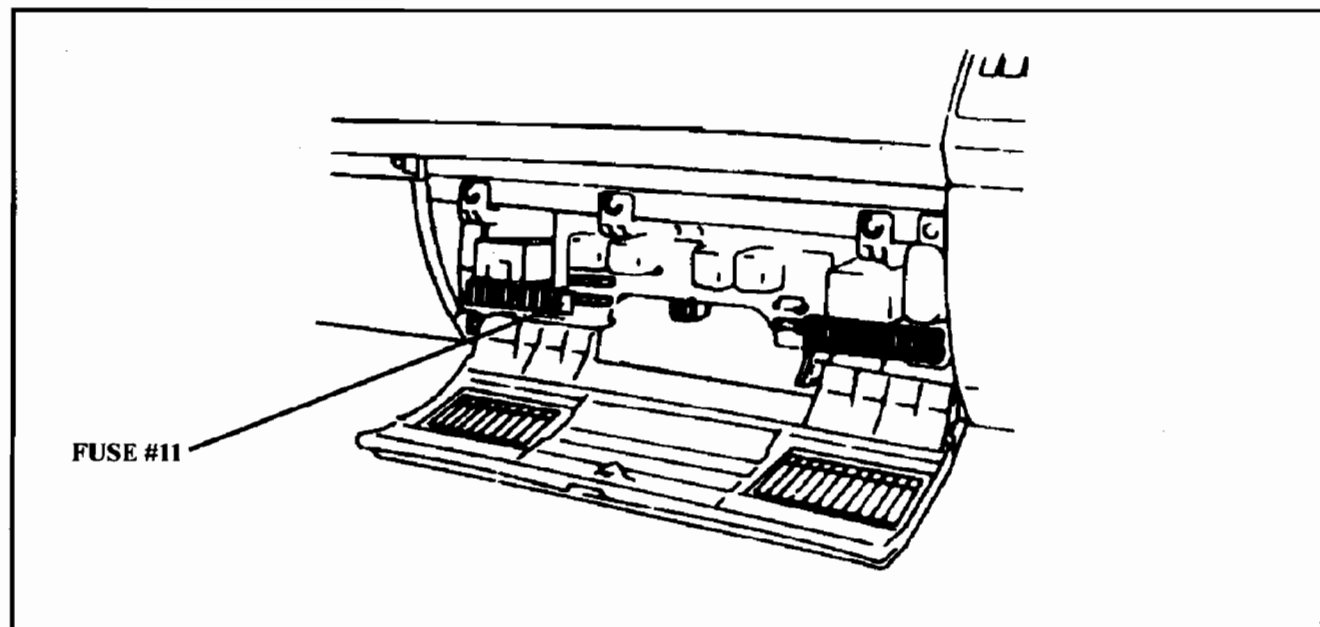


Figure 8

ISUZU NPR/GMC FORWARD TILTMASTER

CODE RETRIEVAL

1992-94 MODELS

Everything for the 1992-94 model years remained the same **EXCEPT** the location of the two wire diagnostic connector which moved to the driver's side kick panel adjacent to the brake master cylinder as shown in figure 9 and Inhibitor Switch code capability was added for the 1993 model year as shown in the code chart in figure 10.

It is a **WHITE** connector with a **YELLOW/BLACK** wire and a solid **BLACK** wire.

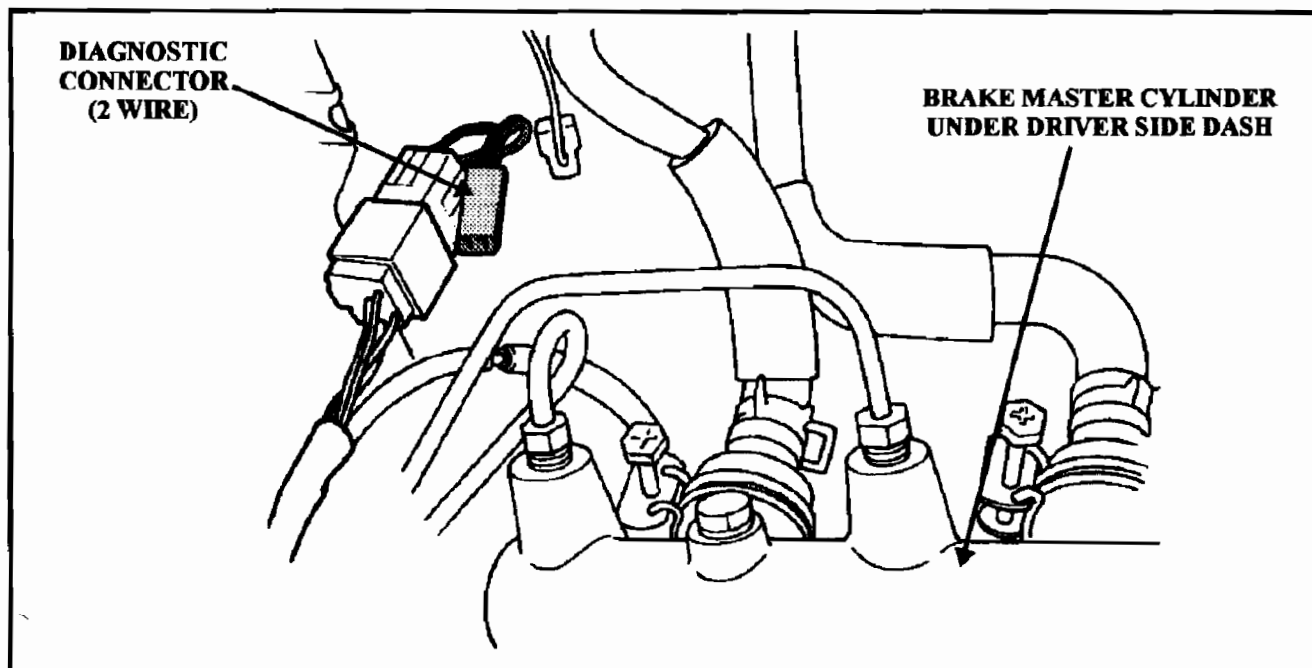


Figure 9

The code chart for the 1992-94 trucks is shown below in figure 10.

1992-94 CODE CHART		
CODE NUMBER	COMPONENT AFFECTED	PROBABLE CAUSE
11	SPEED SENSOR #1	SPEED SENSOR ON TRANSMISSION FAULT
24	SPEED SENSOR #2	SPEED SENSOR IN SPEEDOMETER FAULT
13	ENGINE RPM SENSOR	OPEN OR SHORTED
15	ATF THERMOSENSOR	OPEN OR SHORTED
*17	INHIBITOR SWITCH	OPEN OR SHORTED
21	THROTTLE SENSOR	OPEN OR SHORTED
31	SHIFT SOLENOID "A"	OPEN OR SHORTED
32	SHIFT SOLENOID "B"	OPEN OR SHORTED
33	OVERRUN CLUTCH SOLENOID	OPEN OR SHORTED
34	LOCK-UP SOLENOID	OPEN OR SHORTED
35	LINE PRESSURE SOLENOID	OPEN OR SHORTED

*THIS CODE WAS ADDED FOR THE 1993 MODEL YEAR

Figure 10

ISUZU NPR/GMC FORWARD TILTMASTER CODE RETRIEVAL 1995 MODELS

The 1995 models still uses the Economy Indicator Lamp for code display and the code display pattern also remains the same as 1994 models.

Diagnostic connector location is also the same as the 1992-94 models BUT, the type of connector has changed to a three wire **GREEN** connector. The outer two wires are jumped to retrieve codes as shown in figure 11. These wires are **YELLOW/BLACK** and solid **BLACK**. Fuse #11 is still the one to remove to clear codes.

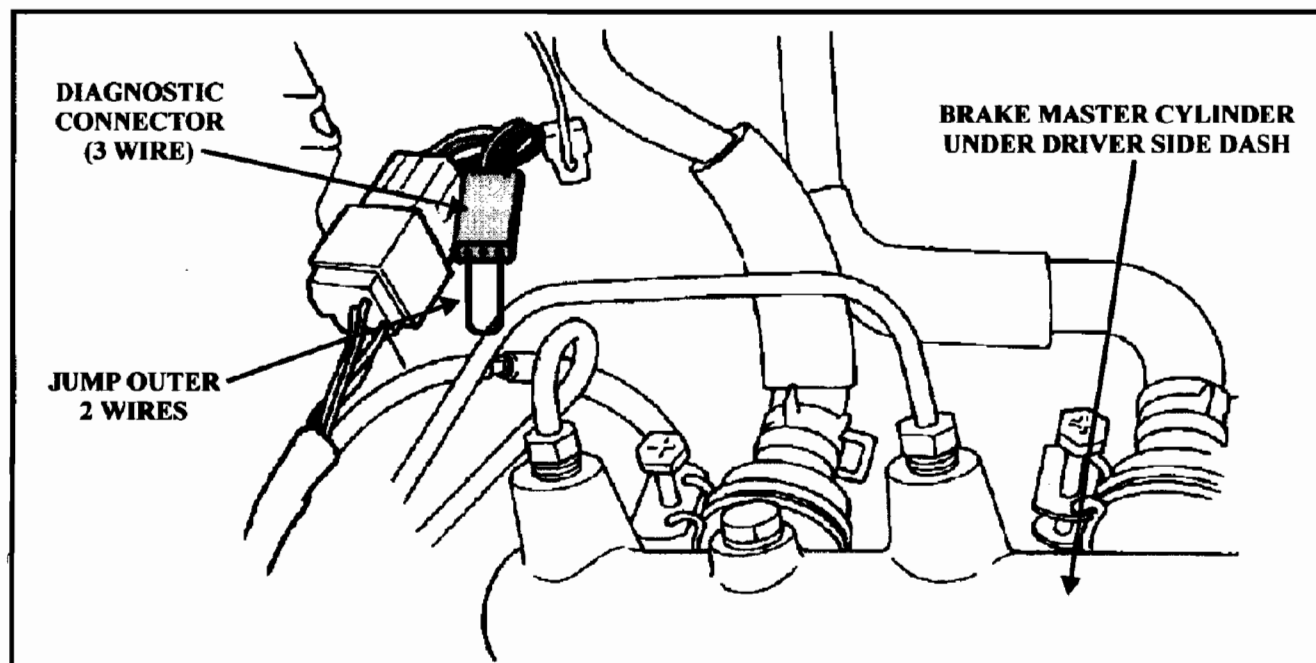


Figure 11

The code chart for the 1995 models is illustrated in figure 12 below.

1995 CODE CHART		
CODE NUMBER	COMPONENT AFFECTED	PROBABLE CAUSE
11	SPEED SENSOR #1	SPEED SENSOR ON TRANSMISSION FAULT
24	SPEED SENSOR #2	SPEED SENSOR IN SPEEDOMETER FAULT
13	ENGINE RPM SENSOR	OPEN OR SHORTED
15	ATF THERMOSENSOR	OPEN OR SHORTED
17	INHIBITOR SWITCH	OPEN OR SHORTED
21	THROTTLE SENSOR	OPEN OR SHORTED
31	SHIFT SOLENOID "A"	OPEN OR SHORTED
32	SHIFT SOLENOID "B"	OPEN OR SHORTED
33	OVERRUN CLUTCH SOLENOID	OPEN OR SHORTED
34	LOCK-UP SOLENOID	OPEN OR SHORTED
35	LINE PRESSURE SOLENOID	OPEN OR SHORTED

Figure 12

ISUZU NPR/GMC FORWARD TILTMASTER

CODE RETRIEVAL

1995½-98 MODELS

Midway through 1995 a new body style was introduced, these were referred to as 1995½ models. The major change in code retrieval was the light that flashes the codes. 1995½-98 models use a "CHECK TRANS" lamp (Refer to Figure 13) that flashes continuously when the Transmission Control Module (TCM) senses a problem and will flash the code pattern when the diagnostic connector is jumped.

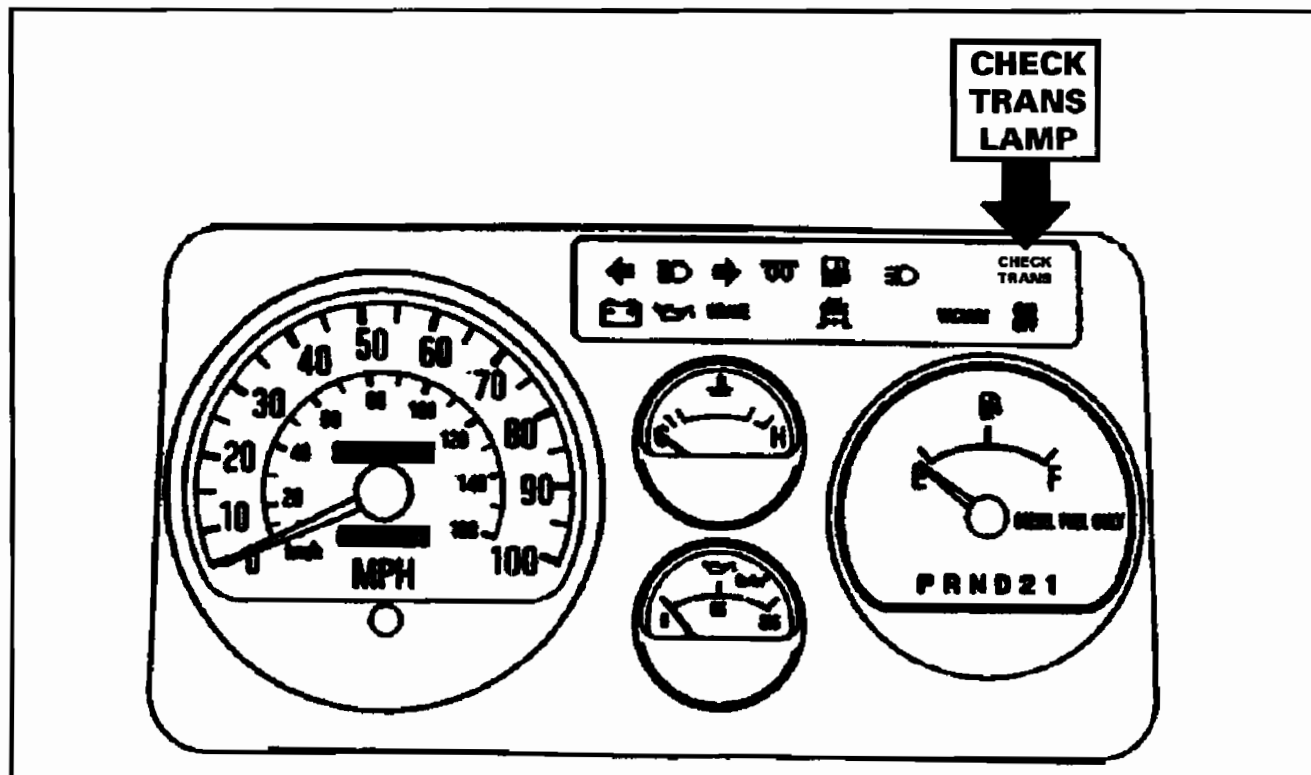


Figure 13

The diagnostic connector is still a three wire GREEN connector and the outer two wires are jumped to retrieve codes. The wire colors to jump are BLACK/WHITE and solid BLACK. The code format remains the same as well as the code chart which can be seen in figure 12

To clear codes, it is now the #16 fuse in the glove box fuse box as shown in figure 14.

NOTE: On Budget Rental trucks, remove **CIRCUIT BREAKER #19**.

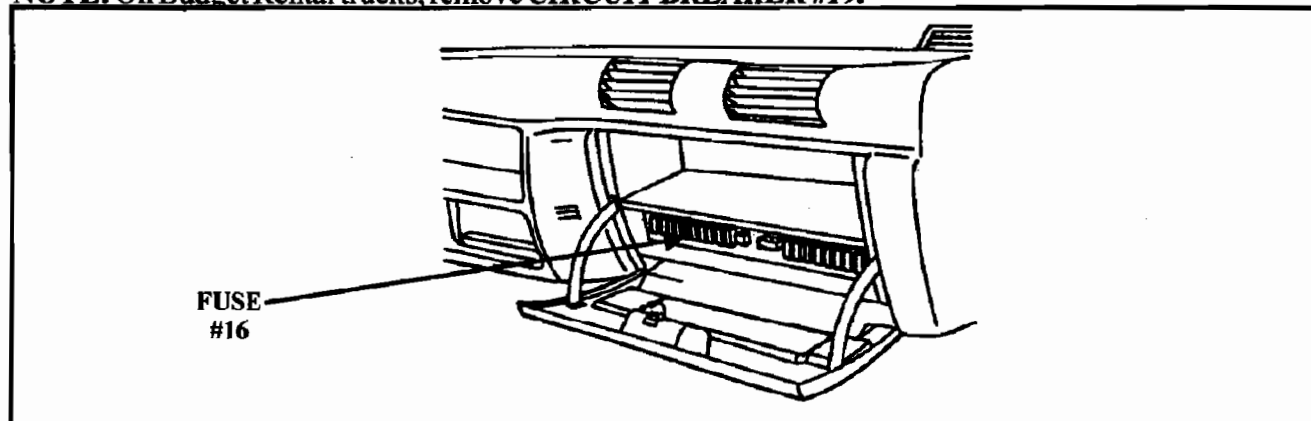


Figure 14

**ISUZU NPR/GMC FORWARD TILTMASTER
CODE RETRIEVAL****1999-2000 MODELS**

Although the 1999-2000 trucks received a new transmission, diagnostic connector location, procedure, the "CHECK TRANS" Lamp function and code format remain the same as 1995½-98 models. The only difference in this area is additional code capability as seen in the code chart in figure 15.

1999-2000 CODE CHART		
CODE NUMBER	COMPONENT AFFECTED	PROBABLE CAUSE
11	SPEED SENSOR #1	SPEED SENSOR ON TRANSMISSION FAULT
24	SPEED SENSOR #2	SPEED SENSOR IN SPEEDOMETER FAULT
13	ENGINE RPM SENSOR	OPEN OR SHORTED
15	ATF THERMOSENSOR	OPEN OR SHORTED
17	INHIBITOR SWITCH	OPEN OR SHORTED
21	THROTTLE SENSOR	OPEN OR SHORTED
31	SHIFT SOLENOID "A"	OPEN OR SHORTED
32	SHIFT SOLENOID "B"	OPEN OR SHORTED
33	OVERRUN CLUTCH SOLENOID	OPEN OR SHORTED
34	LOCK-UP SOLENOID	OPEN OR SHORTED
35	LINE PRESSURE SOLENOID	OPEN OR SHORTED
37	EXHAUST BRAKE SYSTEM	OPEN OR SHORTED
38	ENGINE WARM UP SYSTEM	OPEN OR SHORTED

Figure 15

ISUZU NPR/GMC FORWARD TILTMASTER
COMPUTER LOCATION

1988-95 MODELS

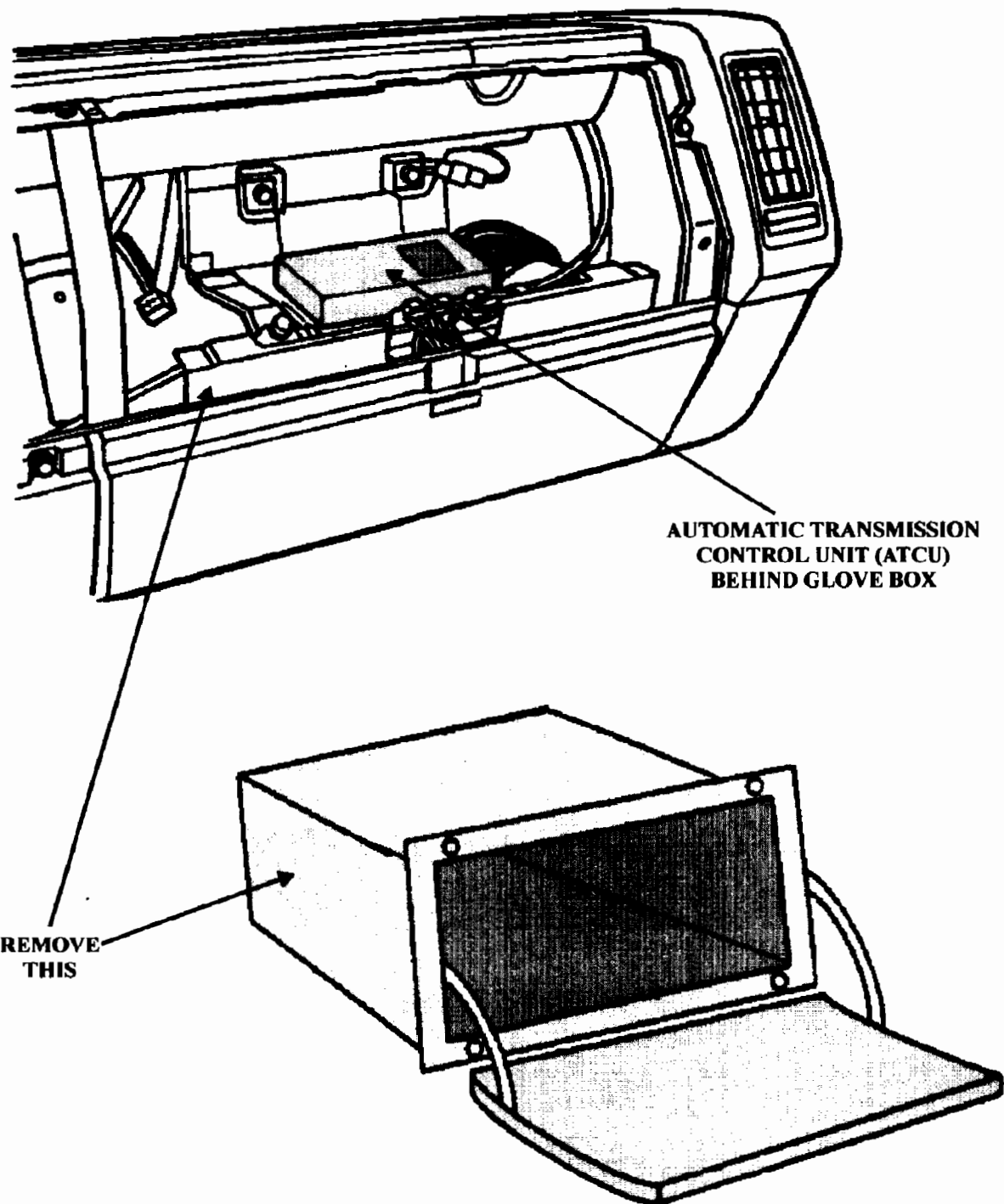
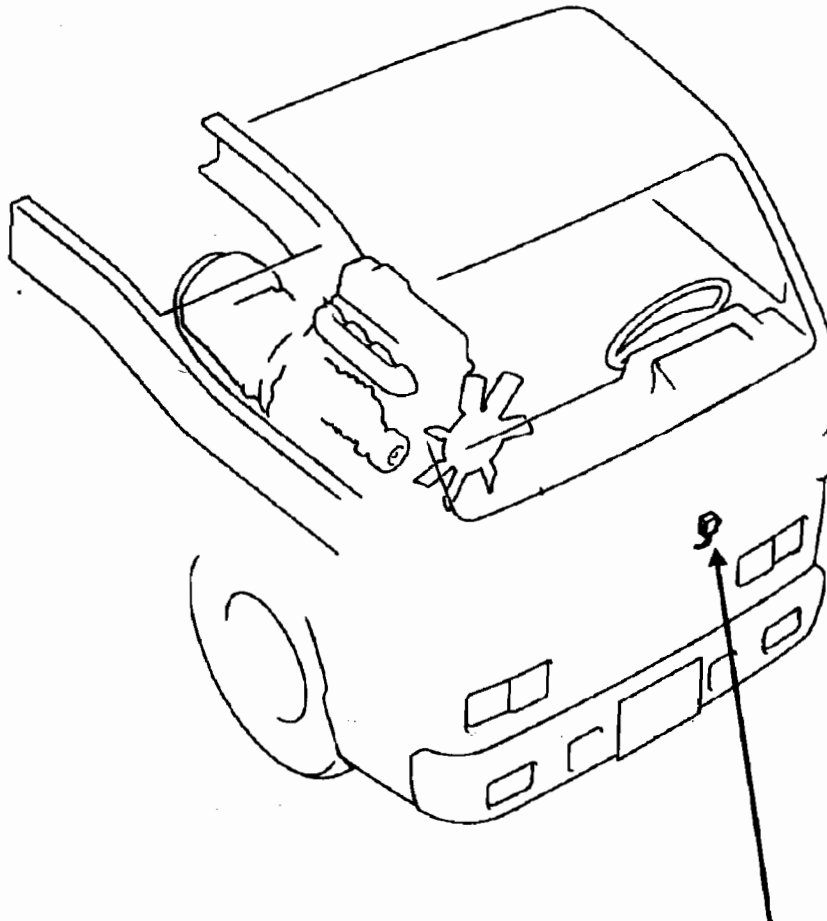


Figure 16

ISUZU NPR/GMC FORWARD TILTMASTER
DROPPING RESISTOR LOCATIONS**1988-95 MODELS**

**THE DROPPING RESISTOR IS LOCATED
BETWEEN THE FRONT SHEET METAL AND A
SUPPORT GIRDER WHICH IT IS MOUNTED ON**

Figure 17

ISUZU NPR/GMC FORWARD TILTMASTER
COMPUTER & DROPPING RESISTOR LOCATION

1995½-98 MODELS

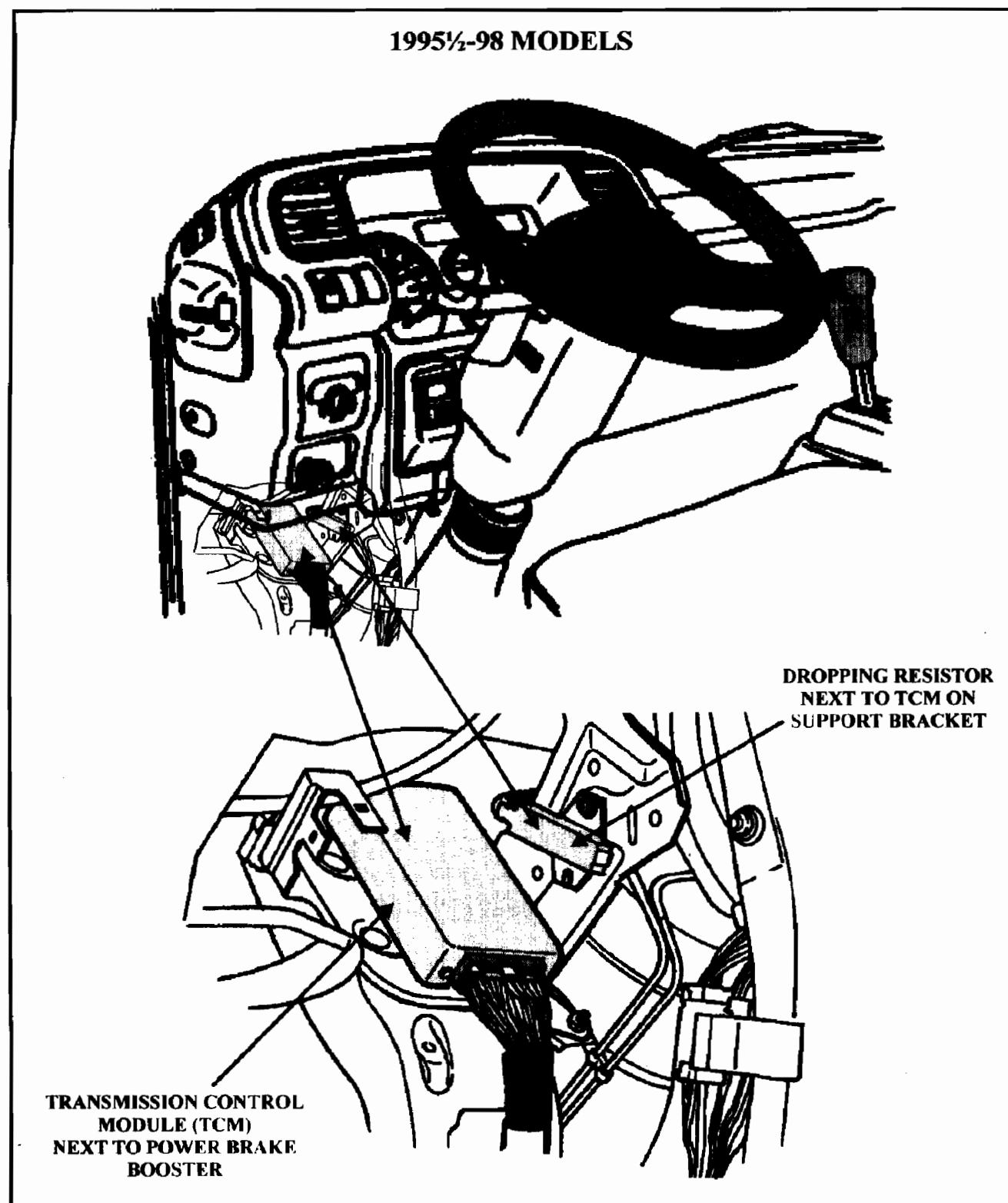


Figure 18

ISUZU NPR/GMC FORWARD TILTMASTER
COMPUTER LOCATION

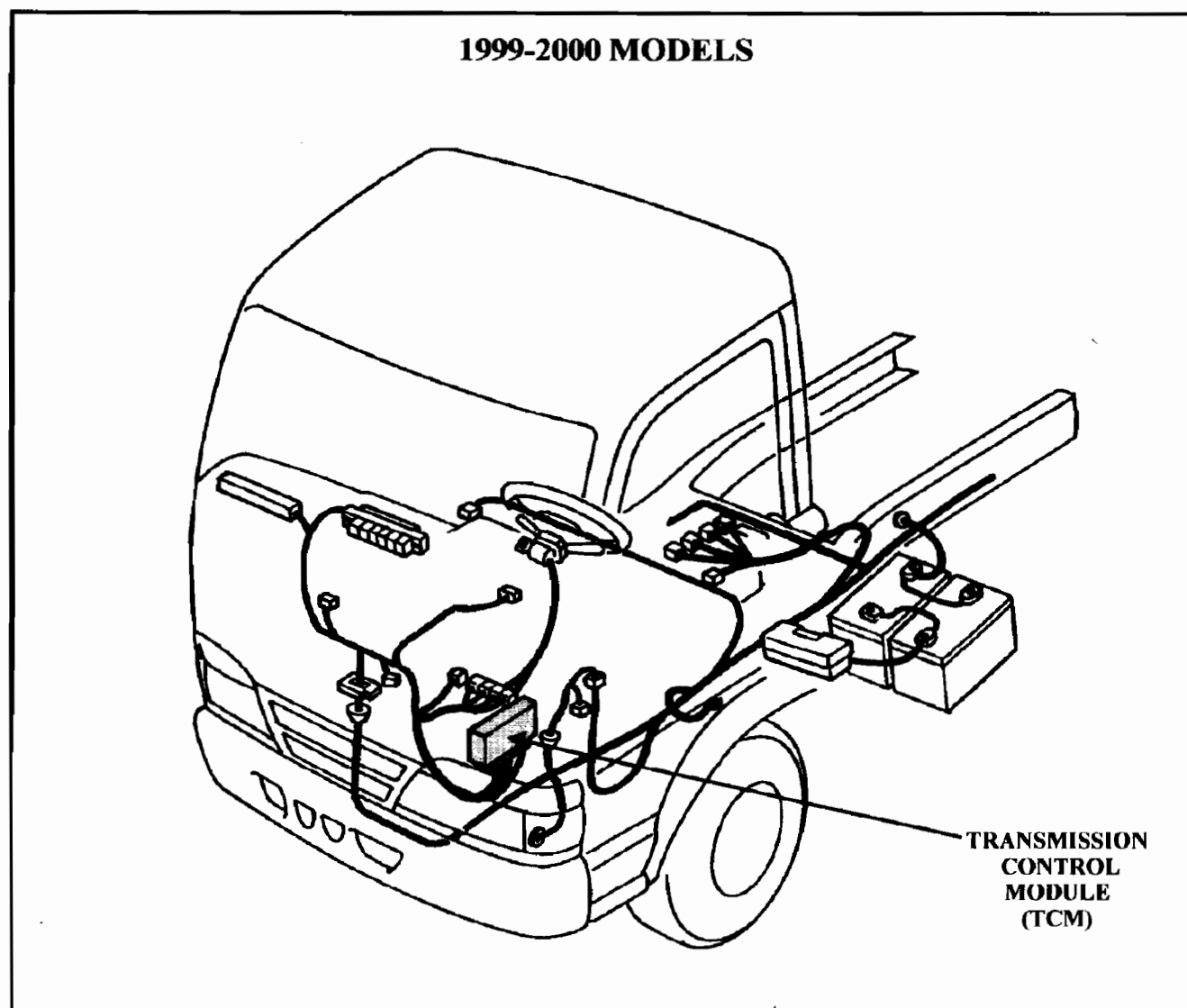


Figure 19



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ISUZU NPR/GMC FORWARD TILTMASTER EXHAUST BRAKE OPERATION

COMPLAINT: Possible complaints due to exhaust brake system failures could be elevated line pressure, premature transmission failure, poor engine performance and slow cab warm-up.

CAUSE: First, an explanation of how this system operates is in order to better understand the causes of the above complaints.

A large driving force is applied to the various clutches and band in the transmission when engine braking is required, especially the overrun clutch. If additional help was not available, these clutches and band would fail prematurely. That's one of the functions of the exhaust brake system, which is to use exhaust back pressure to help slow the truck and thereby helping the transmission to do its job of engine braking without unnecessary damage.

It does this by raising line pressure when the exhaust brake is activated by a switch on the dashboard.

The exhaust brake is also activated by an engine warm-up switch also located on the dashboard.

The exhaust brake uses a vacuum operated valve, located between the engine pipe and the exhaust pipe as seen in the illustration in figure 1, exhaust pipe which is activated by a magnetic valve mounted on the driver side frame rail.

NOTE: *The magnetic valve is not used when the exhaust brake is activated by the engine warm-up switch.*

The exhaust brake system also provides for rapid cab warm up in cold weather.

If the exhaust brake system is electrically stuck on, higher than normal line pressure will be present. If the exhaust brake is mechanically stuck closed, poor engine performance will prevail. If the exhaust brake is inoperative or not used, premature transmission failure can result.

CORRECTION: The exhaust brake, when activated, sends a 12 volt signal to the TCM which in turn initiates exhaust brake line pressure control strategy, and zero volts when it is off.

This signal can be checked at the TCM with a volt meter. Check to see if the exhaust brake valve is stuck shut and if the vacuum diaphragm holds vacuum and that the magnetic valve is working.

ISUZU NPR/GMC FORWARD TILTMASTER EXHAUST BRAKE OPERATION

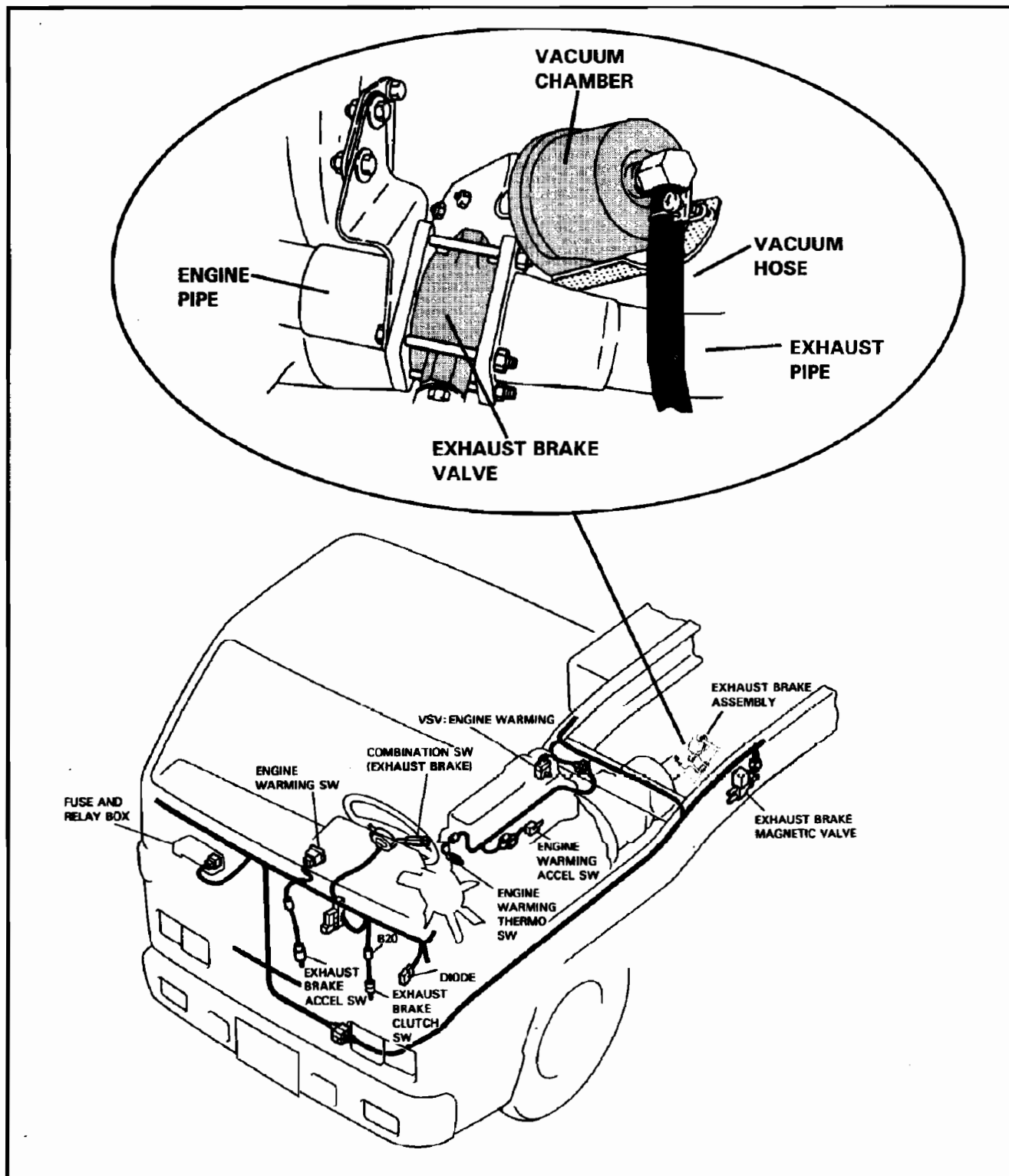


Figure 1

ISUZU NPR/GMC FORWARD TILTMASTER INHIBITOR SWITCH

The inhibitor switch, located on the driver side of the transmission mounted on the manual selector linkage, (Figure1) must send the correct input signals to the TCM from the inhibitor switch to insure proper up and down shifts, a shift to fourth gear, lock-up application and proper exhaust brake operation. ***The rear lighting grounds also have to be in good condition to prevent feedback through the inhibitor switch circuits which can cause erratic shifting.***

It is also important the switch is properly adjusted by inserting 0.15" (4mm) pin (or a 5/32" drill bit) through the hole in the selector lever and the inhibitor switch lever and then tighten the switch before any input signal input is checked as shown in figure 2.

The integrity of the switch can be checked by using the chart in figure 3 to perform continuity checks. In order to check the input signal, use the illustration in figure 4 to perform the voltage checks to the TCM.

It is important to protect the connectors located under a cover mounted on top of the transmission from the elements as damage to these connectors can affect inhibitor switch input as well as the internal electrical transmission components as illustrated in figure 5.

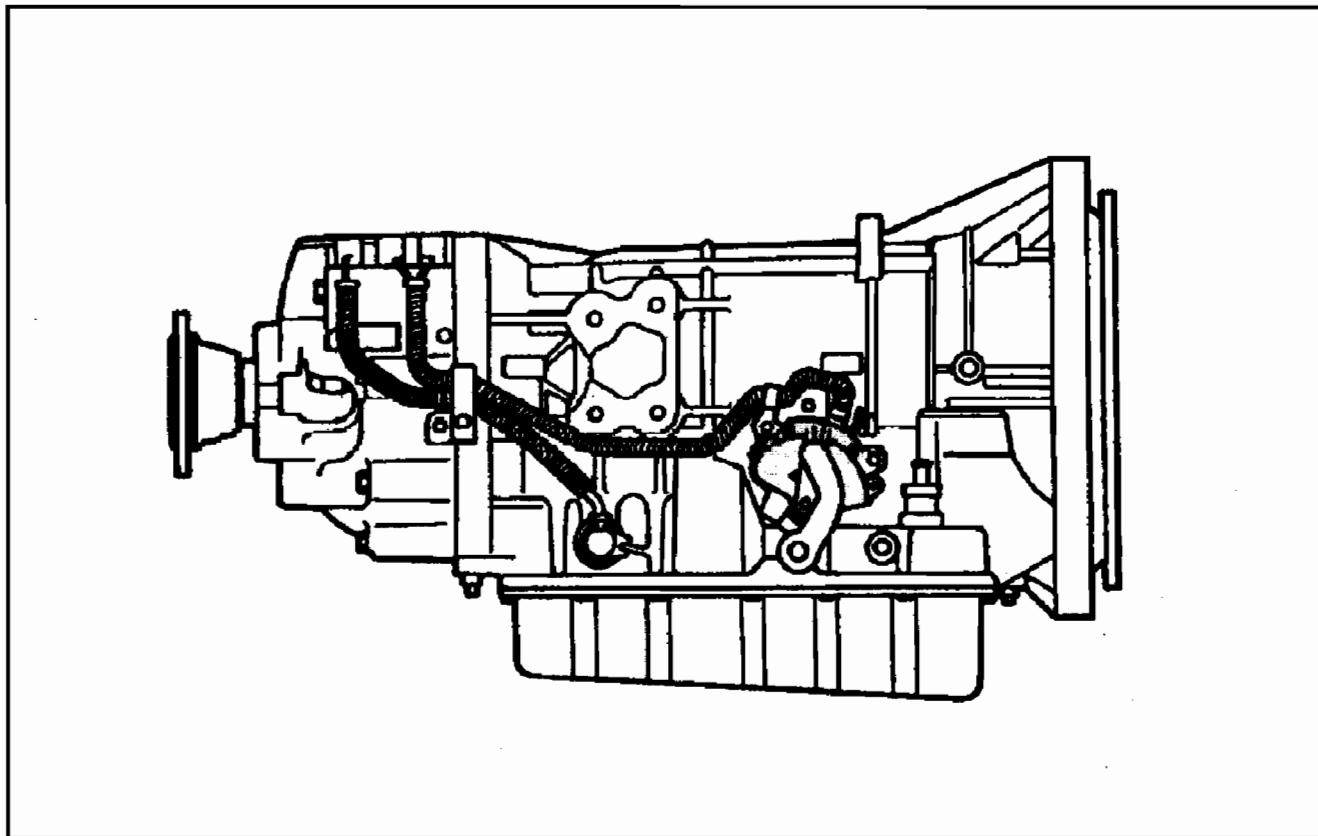


Figure 1

ISUZU NPR/GMC FORWARD TILTMASTER INHIBITOR SWITCH

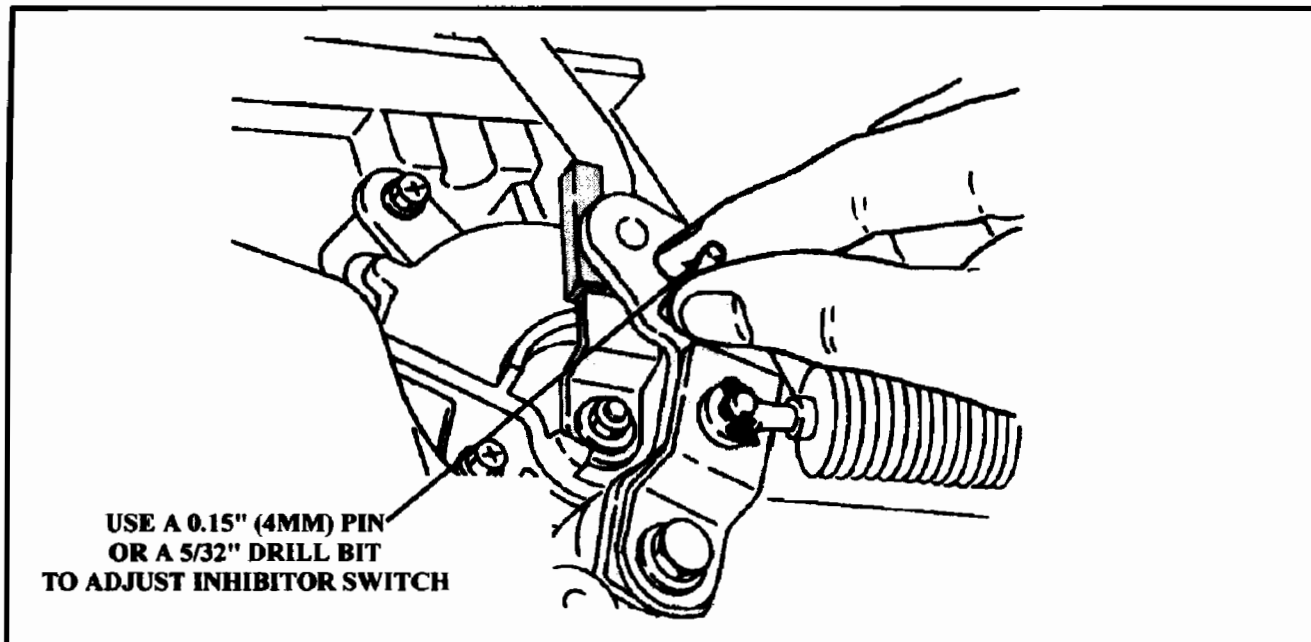
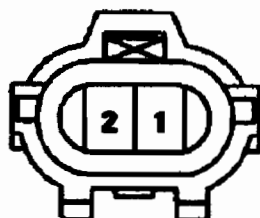


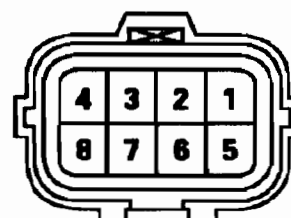
Figure 2

INHIBITOR SWITCH CONTINUITY TEST


	A		B						
	1	2	1	2	3	4	6	7	8
P	○—○					○—○			○
R						○—○		○	
N	○—○					○—○			
D			○—○			○			
2				○—○		○			
1					○—○	○			



A



B



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ISUZU NPR/GMC FORWARD TILTMASTER

VEHICLE SPEED SENSOR #1 & #2

VEHICLE SPEED SENSOR #1

Vehicle speed sensor #1 is located in the extension housing of the transmission, as seen in figure 1, and is excited by the parking gear. VSS #1 is an AC voltage generator and can be checked in AC volts or Hertz (Hz). Usually, more than 1 Volt AC should be seen at 15 mph. The resistance of the sensor is 504-616 ohms. This Sensor is "hard wired" to the TCM

VEHICLE SPEED SENSOR #2 (1988-94)

Vehicle speed sensor #2, within these models years, is located in the speedometer head and is a reed switch type that is driven by the speedometer cable, as seen in figure 2. This sensor is best checked in DC volts at the TCM for a 0-5 volt pulse as the rear wheels are rotated slowly.

This type of sensor is a three wire type that receives a 5 volt voltage supply, a ground circuit and a 0-5 volt signal return. This sensor has ONLY the signal return wire going to the TCM

NOTE: If VSS #1 fails, VSS #2 will take over control of transmission shift scheduling.

VEHICLE SPEED SENSOR #2 (1995 & LATER)

Beginning with the 1995 model year VSS #2 was moved to the transmission and became a gear driven AC voltage generator, as seen in figure 3, and can be checked in Hz: 21 Hz @ 21 MPH

51 Hz @ 45 MPH

This sensor is "hard wired" to the TCM.

NOTE: If VSS #1 fails, VSS #2 will take over control of transmission shift scheduling.

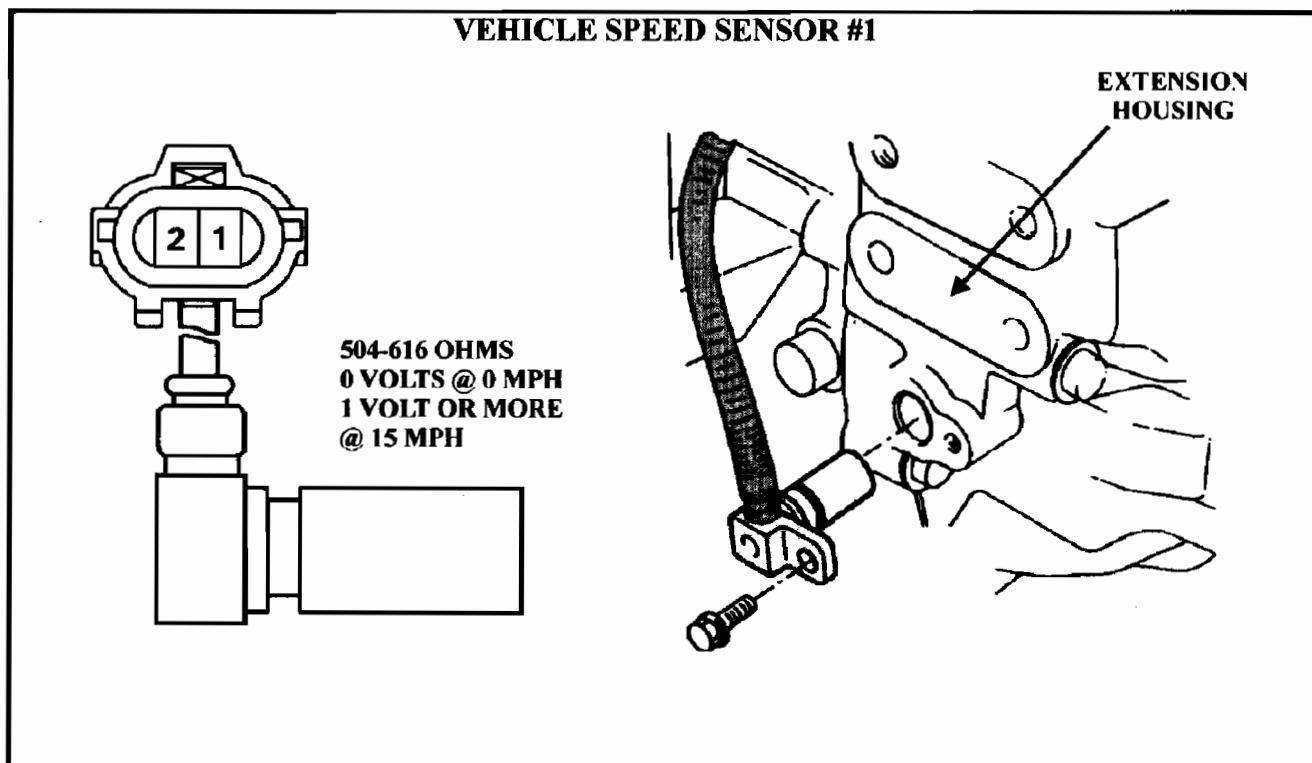


Figure 1

ISUZU NPR/GMC FORWARD TILTMASTER

VEHICLE SPEED SENSOR #1 & #2

VEHICLE SPEED SENSOR #2 IN SPEEDOMETER HEAD (1988-94)

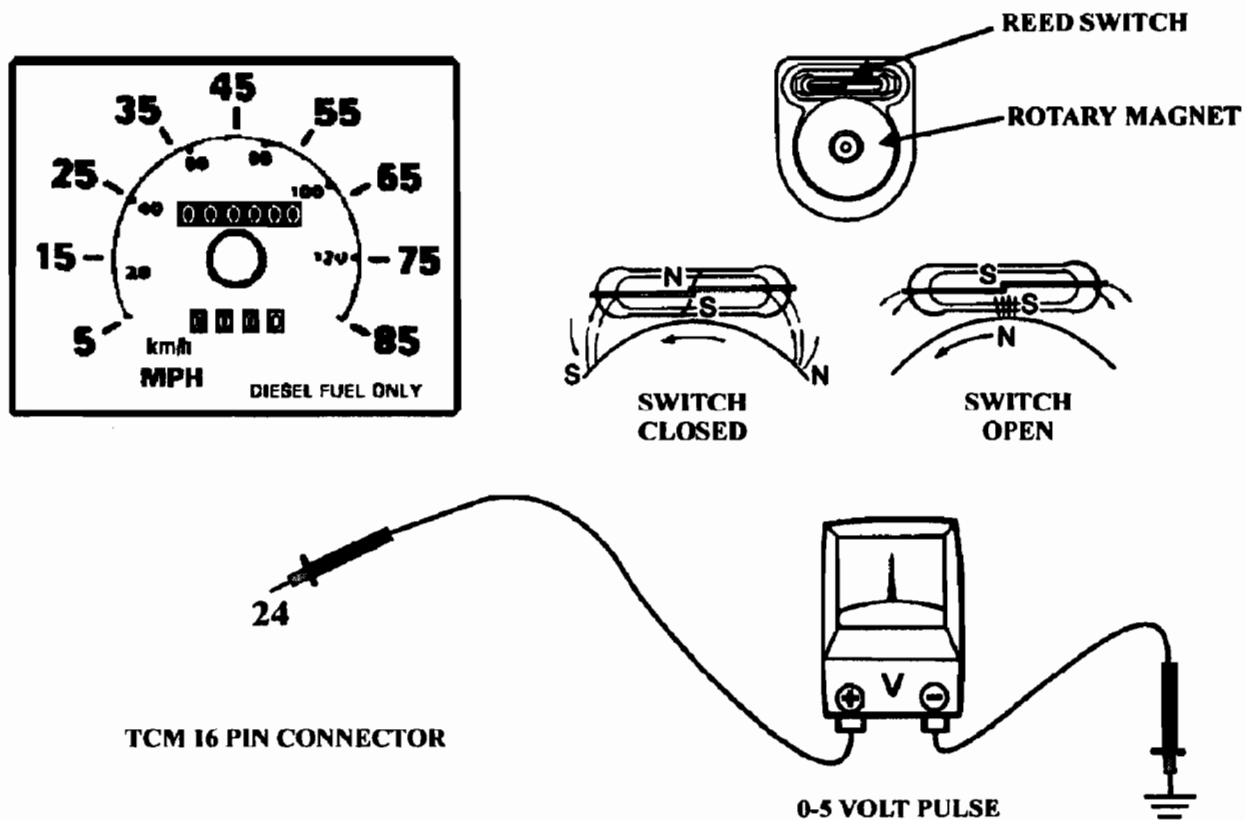


Figure 2

VEHICLE SPEED SENSOR #2 IN TRANSMISSION (1995 & LATER)

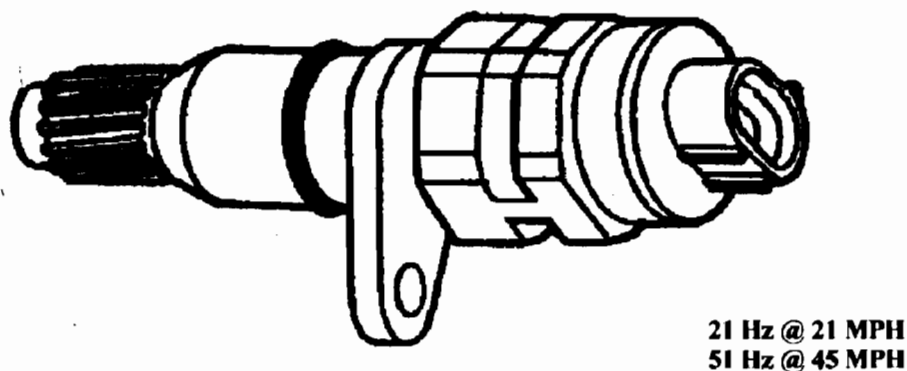


Figure 3

1990-95 ISUZU TROOPER & RODEO 1994-95 HONDA PASSPORT

TCM IDENTIFICATION AND OPERATION

COMPLAINT: Shift solenoid codes (17, 25, 26 or 28), band apply solenoid codes (34 or 35), and ground circuit relay codes (43), are stored in 1990 to 1993 Isuzu Trooper and Rodeo.
Shift solenoids (31, 32, 41 or 42), and band apply solenoid (34 or 44), shorted to ground or shorted to power codes (46), are stored in 1994-95 Isuzu Trooper, Rodeo and Honda Passport all of which result in limp mode.
In some instances a newly installed computer is instantly destroyed as soon as the ignition is turned on.

CAUSE: There are various causes for the above complaints such as, faulty solenoids, faulty case connector, internal or external wiring concerns, loss of ground or system voltage problems such as overcharging.
Another main concern is to identify which of the two different control systems used in these vehicles you are working with and how they operate when the need for diagnostics for the above codes arises due to the fact that the two systems function **OPPOSITE** of each other.

CORRECTION: The first step is to identify which system the vehicle is using. 1990-93 Isuzu Trooper and Rodeo use a Bosch computer control system, as shown in figure 1. 1994-95 Isuzu Trooper, Rodeo and Honda Passport use a GM Delco computer control system as shown in figure 2.
The Bosch computers have a two letter ID code as shown in figure 1, while the GM Delco computers have a four letter ID code as shown in figure 2.

Matching the correct TCM to vehicle application can be done by using the chart in figure 3.

The wiring diagram in figure 4 illustrates how the **BOSCH** system operates, the **Brown/White** wire at TCM terminal 54 provides ground for the solenoids as soon as the ignition is turned on through the TCM internal ground relay. To energize the solenoids the TCM provides battery voltage at terminals 43, 45 and 48 as needed.

The wiring diagram in figure 5 illustrates how the **GM DELCO** system operates, the **Brown/White** at TCM terminal C12 provides battery voltage for the solenoids as soon as the ignition is turned on. ***This is absolutely opposite of circuit operation of the Bosch system!***
To energize the solenoids, the TCM provides a ground signal to TCM terminals A2, A3 and A9 as needed.

This is absolutely opposite of circuit operation of the Bosch system!
Although terminal locations are different, Wire color for both the Bosch and GM DELCO systems are the same.

CAUTION: The Bosch TCM should be in 1990-93 Isuzu Trooper and Rodeo only, and the GM Delco TCM should be in 1994-95 Isuzu Trooper and Rodeo as well as the Honda Passport, BUT, to be certain, check which TCM the vehicle you are working on has.

1990-95 ISUZU TROOPER & RODEO 1994-95 HONDA PASSPORT

TCM IDENTIFICATION AND OPERATION

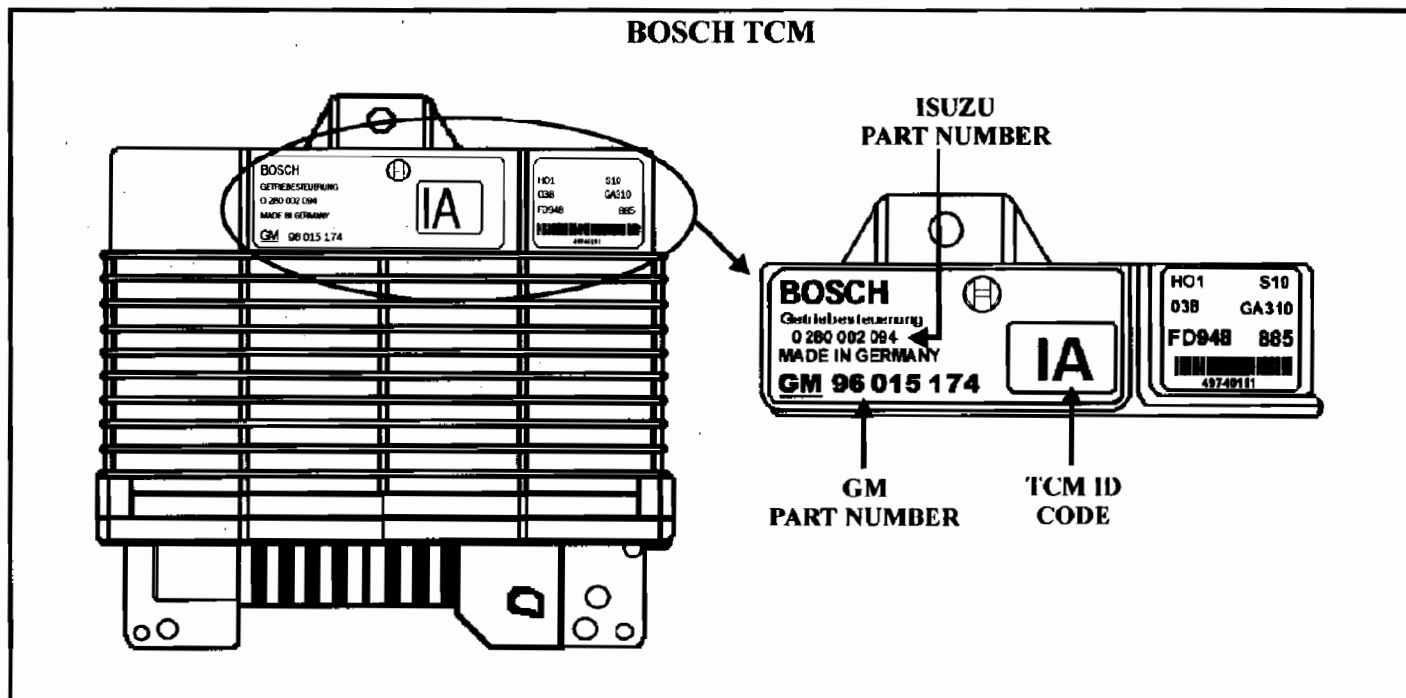


Figure 1

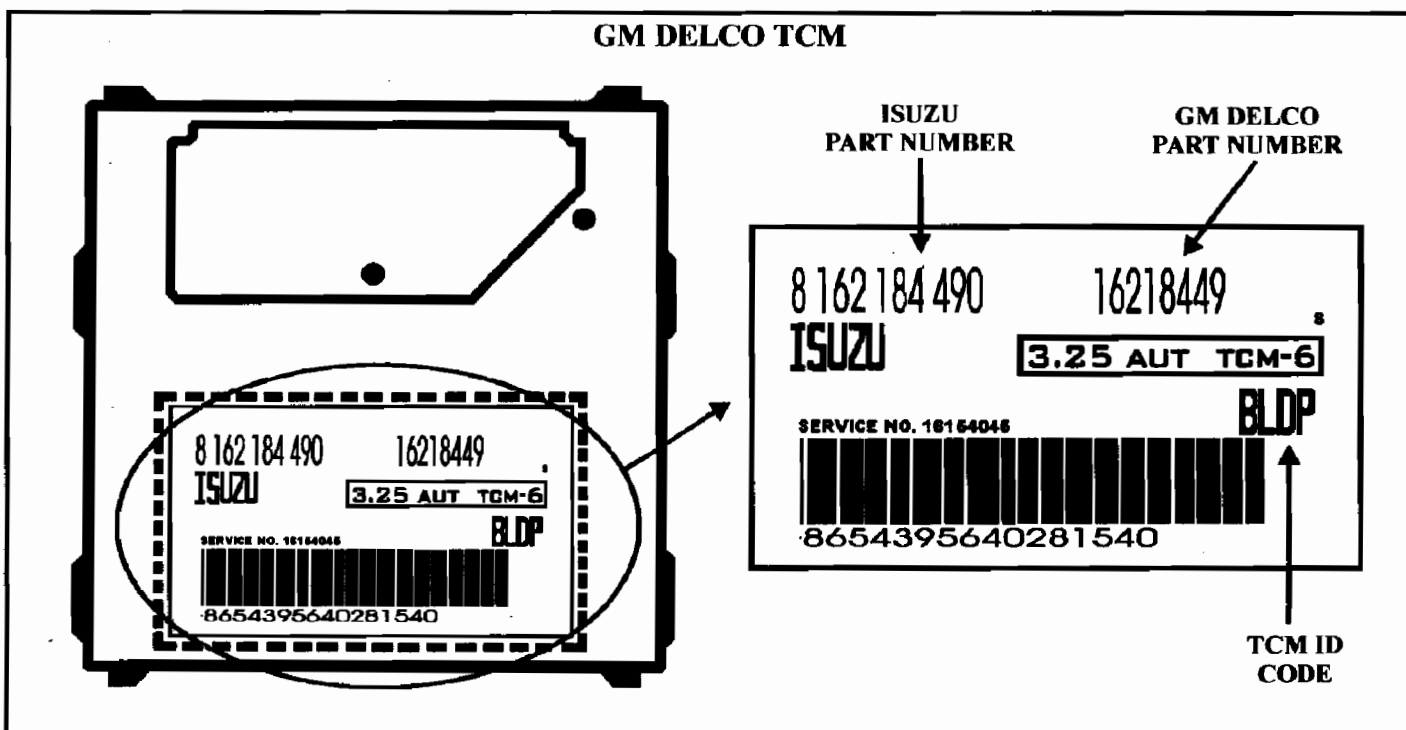


Figure 2

1990-95 ISUZU TROOPER & RODEO

1994-95 HONDA PASSPORT

TCM IDENTIFICATION AND OPERATION

TCM TO VEHICLE IDENTIFICATION CHART

ISUZU MODEL	APPLIED DATE	ENGINE SIZE	TCM CODE	TCM PART NUMBER
Trooper KT	9/89 - 5/90	2.8L V6	IA or IF	8-96042-010-0
Trooper KT	6/90 - 9/91	2.8L V6	IA or IF	8-96042-010-0
Trooper UX	10/91 - 7/93	3.2L V6 SOHC	ID	8-96042-018-0
Trooper UX	8/93 - 10/94	3.2L V6 SOHC	BPJS, BNCW, BLDP, BKRS, BHZD	8-16218-439-0
Trooper UX	11/94 - 8/95	3.2L V6 SOHC	BPJS, BNCW, BLDP, BKRS, BHZD	8-16218-439-0
Trooper UX	10/91 - 7/93	3.2L V6 DOHC	IE	8-96042-020-0
Trooper UX	8/93 - 10/94	3.2L V6 DOHC	BPJT, BNCT, BKRP, BHZE, BFMN	8-16218-449-0
Trooper UX	11/94 - 3/95	3.2L V6 DOHC	BPJT, BNCT, BKRP, BHZE, BFMN	8-16218-449-0
Rodeo UC	5/90 - 10/91	3.1L V6 4X2	IG	8-96042-012-0
Rodeo UC	5/90 - 10/91	3.1L V6 4X4	IG	8-96042-012-0
Rodeo UC	11/91 - 10/92	3.1L V6 4X2	IH	8-96042-014-0
Rodeo UC	11/91 - 10/92	3.1L V6 4X4	IH	8-96042-014-0
Rodeo UC	11/92 - 8/93	3.2L V6 4X2	IR	8-96017-064-0
Rodeo UC	9/93 - 8/94	3.2L V6 4X2	BMUF, BLDN, BJJS BKRU, BFMR	8-16210-629-0
Rodeo UC	11/92 - 8/93	3.2L V6 4X4	IR	8-96017-064-0
Rodeo UC	9/93 - 8/94	3.2L V6 4X4	BMUF, BLDN, BJJS BKRU, BFMR	8-16210-629-0
Rodeo UC	9/94 - 4/95	3.2L V6 4X2	BMUF, BLDN, BJJS BKRU, BFMR	8-16210-629-0
Rodeo UC	5/95 - 11/95	3.2L V6 4X2	BPJP	8-16218-419-0
Rodeo UC	9/94 - 4/95	3.2L V6 4X4	BMUF, BLDN, BJJS BKRU, BFMR	8-16210-629-0
Rodeo UC	5/95 - 11/95	3.2L V6 4X4	BPJP	8-16218-419-0

NOTE: Honda Passport is the same as an Isuzu Rodeo

Figure 3

1990-95 ISUZU TROOPER & RODEO 1994-95 HONDA PASSPORT TCM IDENTIFICATION AND OPERATION

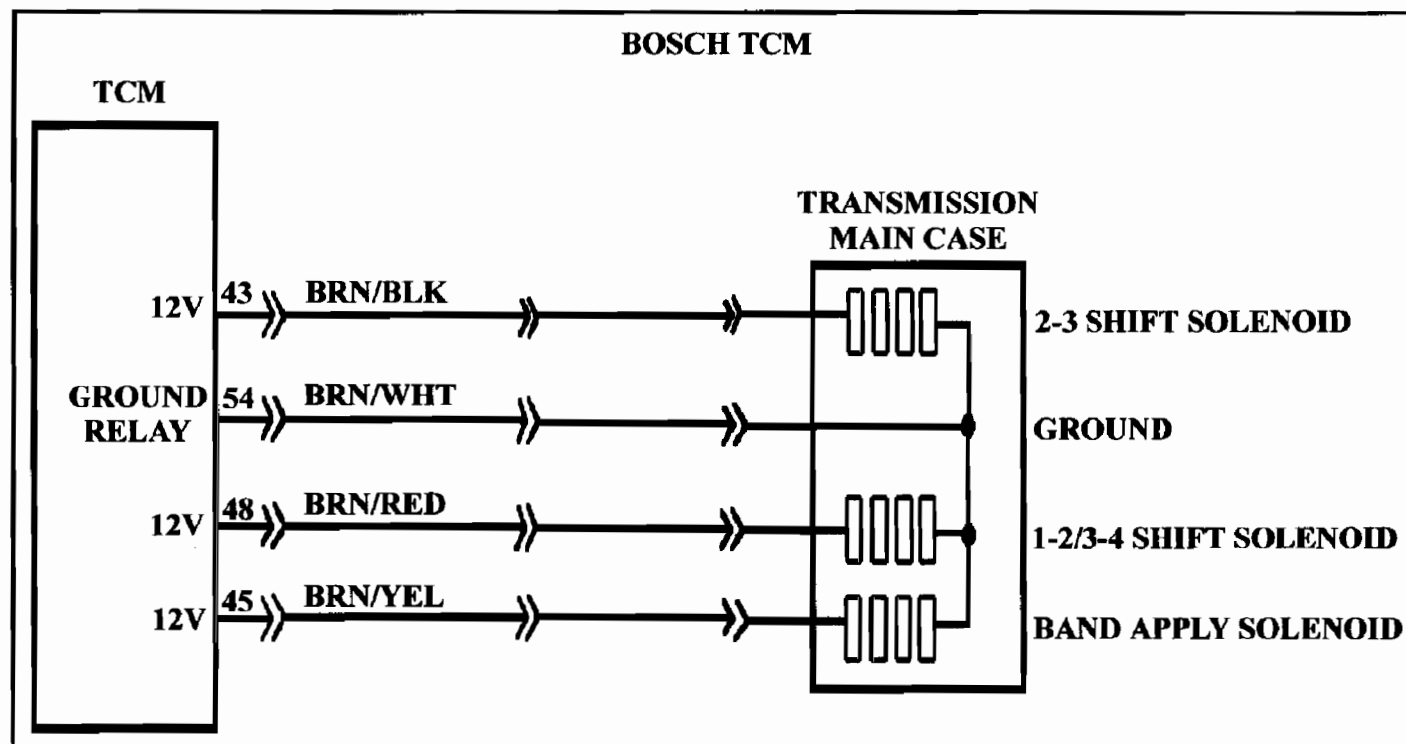


Figure 4

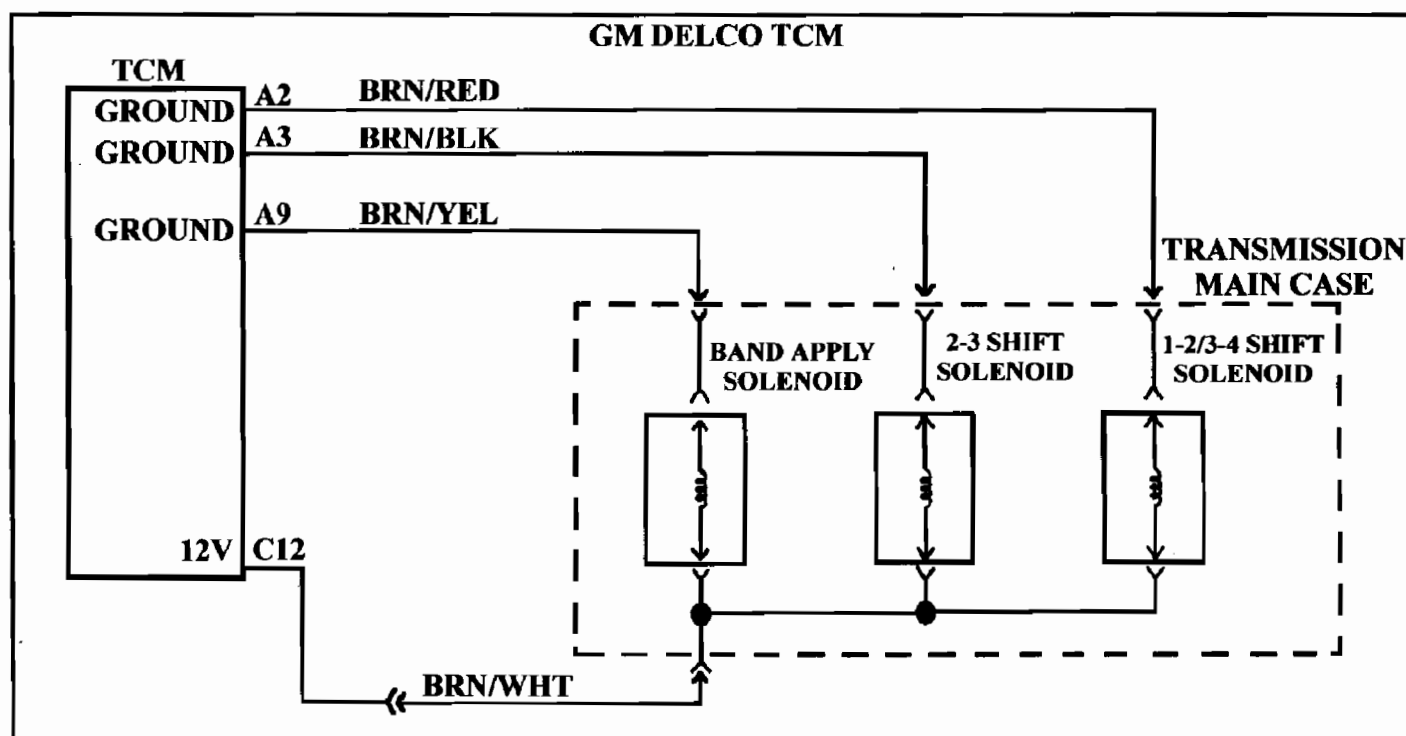


Figure 5

MAZDA/FORD GF4A-EL NO 4TH GEAR, AFTER REBUILD

COMPLAINT: Vehicles equipped with *GF4A-EL* transaxles may exhibit a NO 4th gear condition after overhaul.

CAUSE: The cause may be, a 12 projection *G4A-EL* Reverse, Forward and Coast drum was installed into a *GF4A-EL* application, which requires a 32 projection drum. When this happens the computer will not command 4th gear because of the missing projections which results in slower drum speed.

CORRECTION: To correct this condition, refer to Figure 1 for drum identification and ensure that the 32 projection drum is installed on all *GF4A-EL* applications.

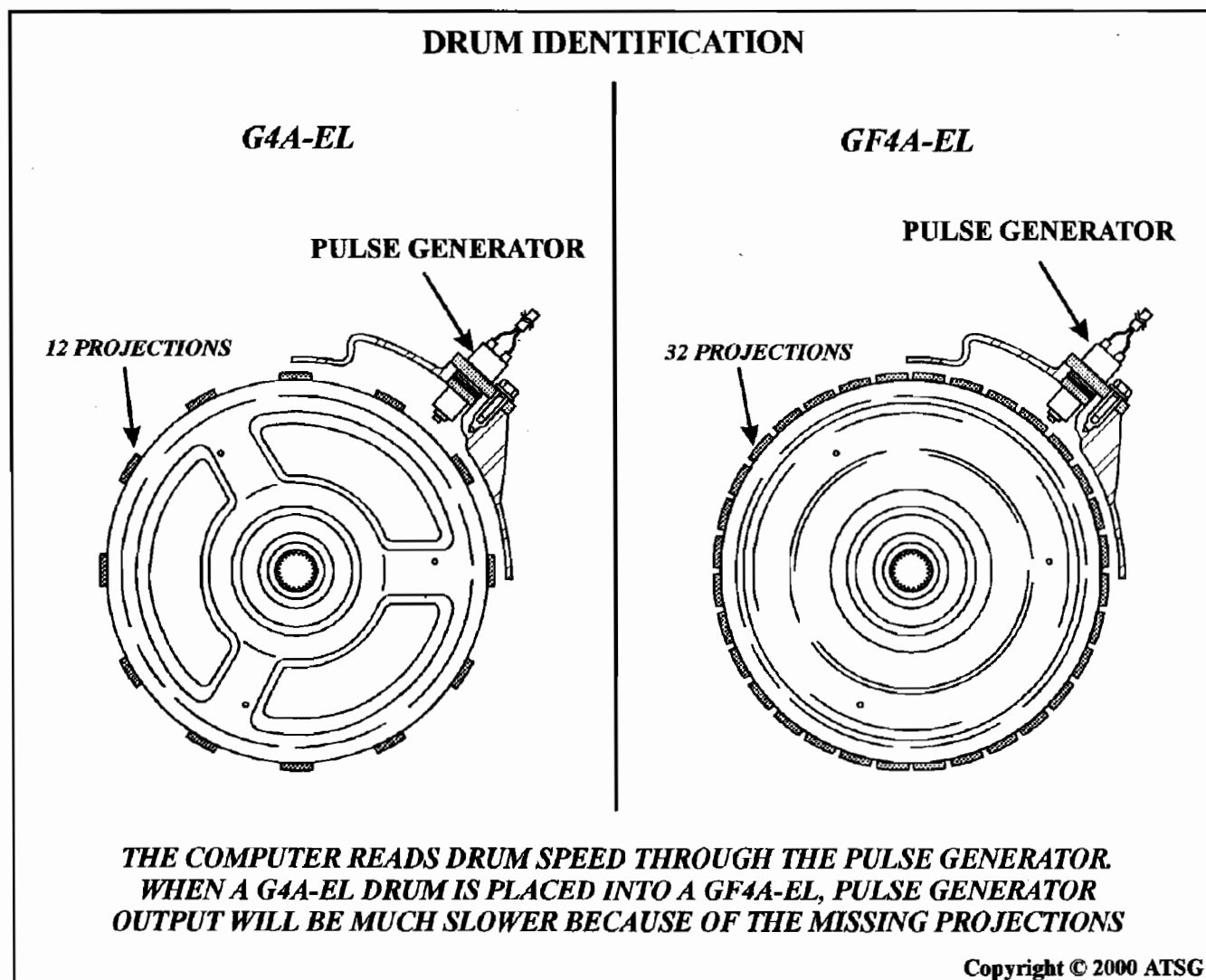


Figure 1



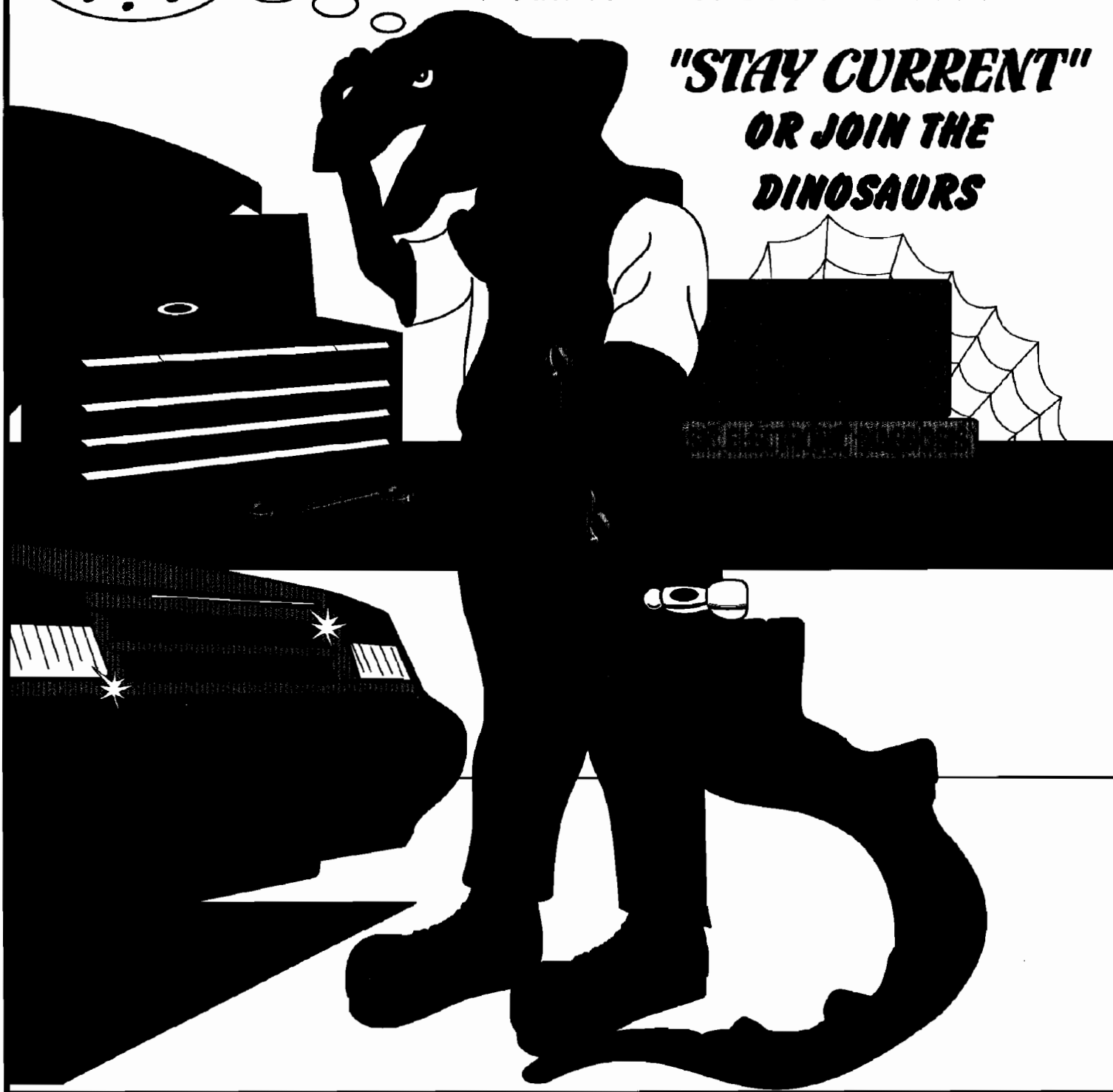
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MERCEDES BENZ 722.5

LOWER VALVE BODY IDENTIFICATION

The following information is intended to show the differences between the 722.5 lower valve body for rear pump models and for models without rear pump, as well as small part locations.

The lower valve body shown in figure 1 is a rear pump equipped model, and the lower valve body shown in figure 2 is non-rear pump equipped model.

In figure 1 there is a rubber washer that is often lost and goes unnoticed, this rubber washer is located at the bottom of the valve and spring seen in the illustration below.

Thanks to Mario Aristides for his technical assistance in compiling this information.

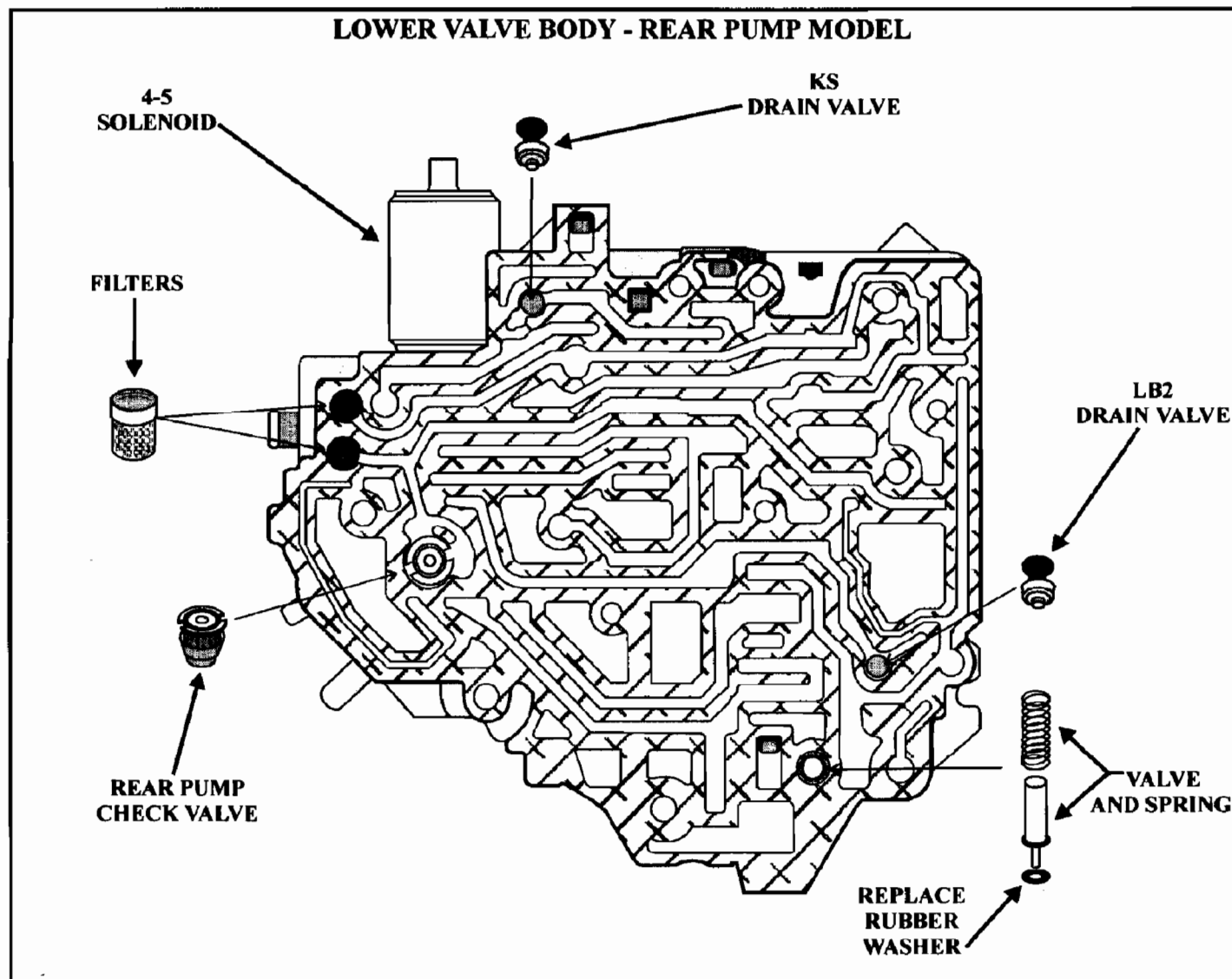


Figure 1

MERCEDES BENZ 722.5

LOWER VALVE BODY IDENTIFICATION

LOWER VALVE BODY - NON-REAR PUMP MODEL

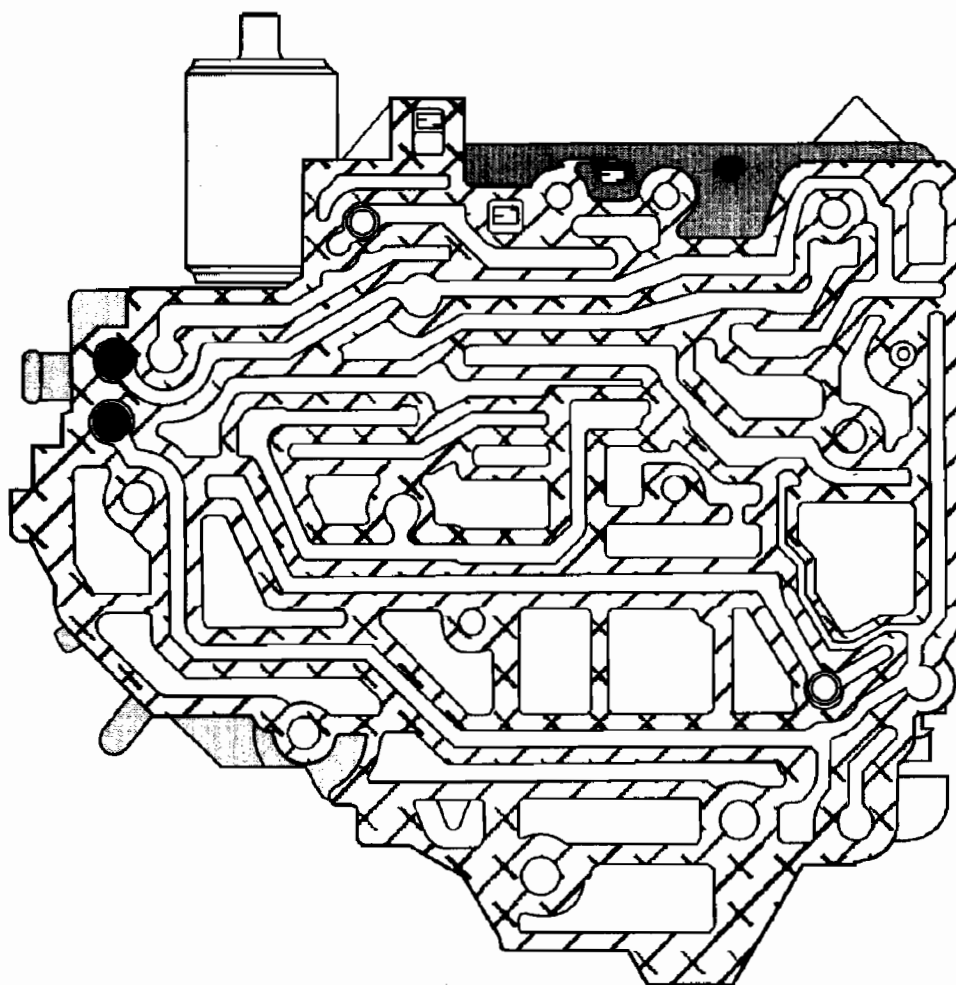


Figure 2

MERCEDES BENZ 722.3, 722.4 & 722.5 EQUIPPED WITH REAR PUMP ELIMINATION KIT

SLIPPING ON TAKE-OFF

COMPLAINT: After installation of a transmission that is equipped with a rear pump elimination kit, (Refer to figure 1), the transmission exhibits slipping on initial take-off.

CAUSE: The lower cover section of the valve body still contains the Secondary Pump Shift Valve, See Figure 2. When this valve strokes, it allows B2 apply oil to exhaust, which causes the transmission slip on take-off. This directly affects the application of the B2 band which is necessary for forward movement.

CORRECTION: Install the aluminum plug seen in figure 2, in place of the secondary pump shift valve train, using only the retainer and the aluminum plug.

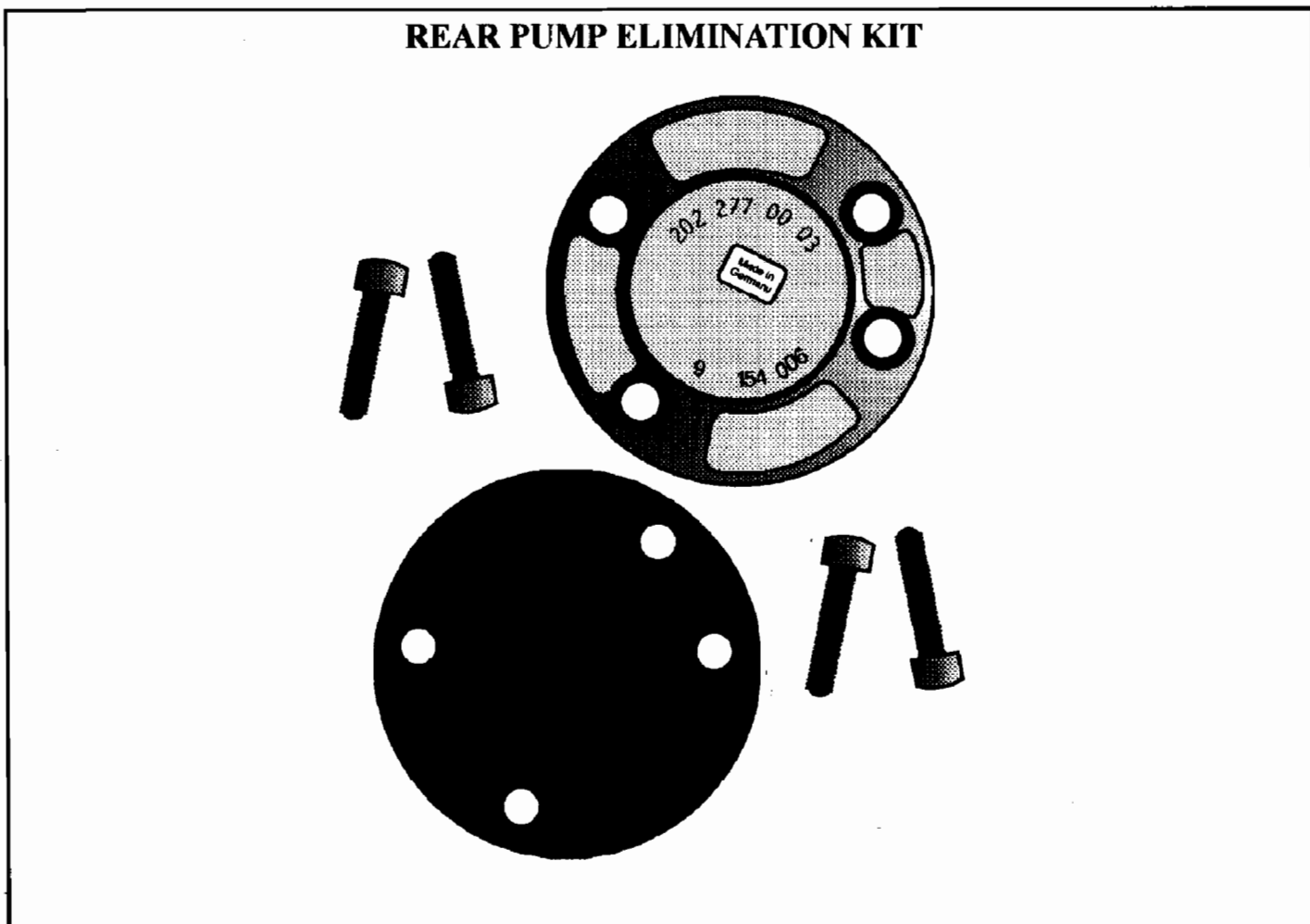


Figure 1

**MERCEDES BENZ 722.3, 722.4 & 722.5 EQUIPPED
WITH REAR PUMP ELIMINATION KIT**

SLIPPING ON TAKE-OFF

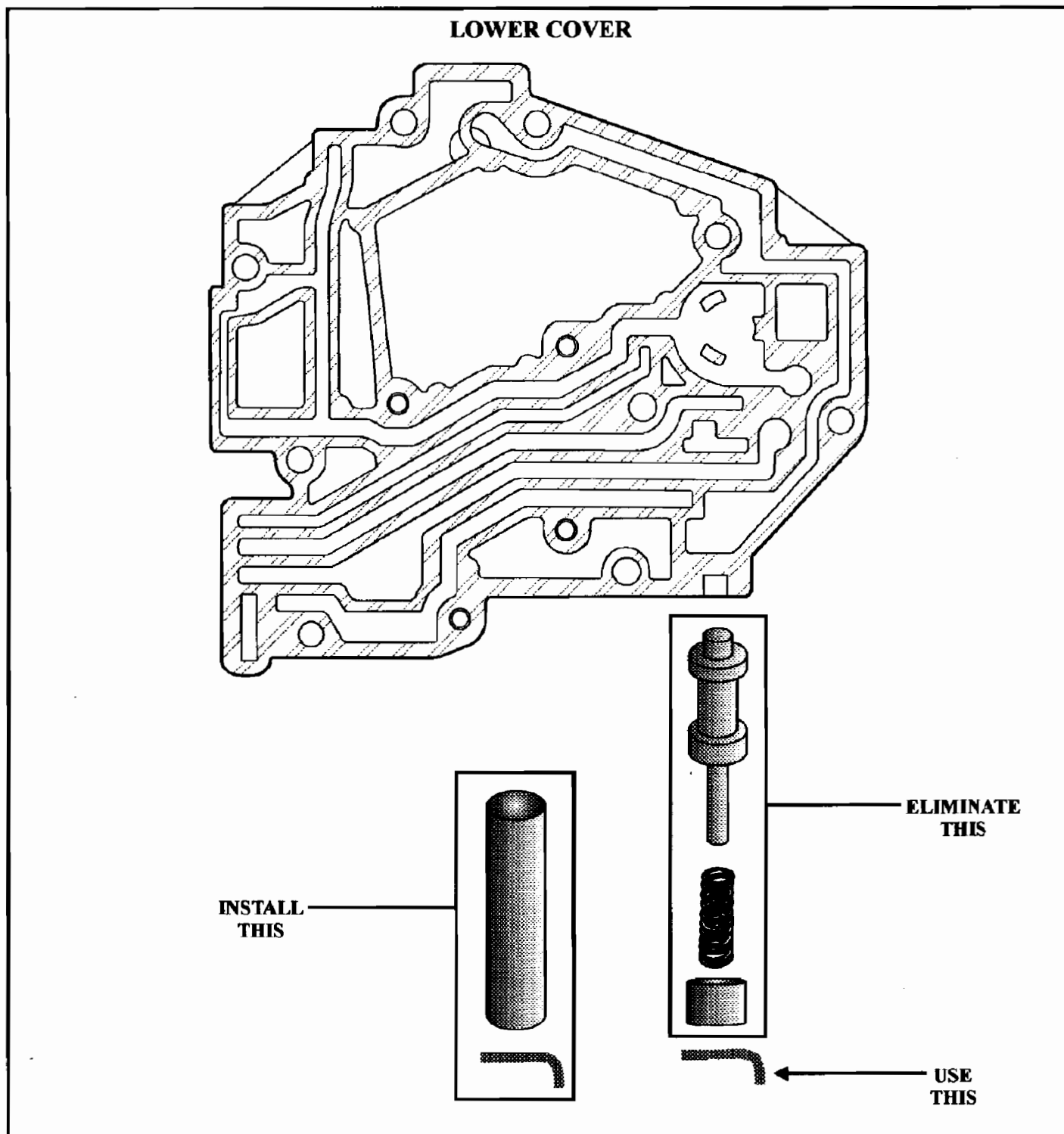


Figure 2



MERCEDES BENZ 722.3, 722.4 & 722.5

REVERSE CONCERNS

COMPLAINT:

- (1) Harsh reverse engagement hot or cold, before and/or after overhaul.
- (2) Delayed reverse engagement on 722.5 with rear pump, hot or cold, before and/or after overhaul.
- (3) Delayed reverse engagement on 722.3 and 722.5 without rear pump, hot or cold, before and/or after overhaul.

CAUSE:

- (1) The harsh reverse engagement is a result of the flat steel plate not providing enough of a cushioning effect for the application of the B3 clutch. In addition, the B3 piston return springs are too weak. (Refer to Figure 1)
- (2) & (3) Delayed reverse engagement caused by pressure leaking between the valve body separator plate and the KS Drain Valve in the transmission case. The orifice feed in the separator plate shown in figures 2 and 3 were made too large (4MM) by the factory.
Delayed reverse engagement caused by the checkball in the valve body, shown in figure 4, not seating properly resulting in a loss of B3 apply oil.

CORRECTION:

- (1) On 722.3, 722.4 and 722.5 replace the thick flat steel plate that is normally positioned on top of the B3 piston with the dished plate in the direction indicated in figure 1. The twenty B3 piston return springs, also shown in figure 1, should also be replaced at this time.
- (2) On 722.5 with rear pump reduce the 4MM (.157") hole in the separator plate shown in figure 2 to 2MM (.787").
- (3) On 722.5 without rear pump and 722.3 reduce the 4MM hole in the separator plate shown in figure 3 to 2MM. If your separator plate has the large hole shown in figure 3, replace the separator plate.
If the vehicle is a 1992 or later, this problem has been corrected by the factory.
On 722.3 and 722.5, discard the checkball shown in figure 4 and enlarge the hole in the bottom of the checkball pocket to .159" (4.4MM). Then tap the hole for a 10-32 machine screw thread and screw a 10-32 machine screw into the threaded hole as shown in figure 5.

SERVICE INFORMATION:

B3 Dished Plate for 722.3 and 722.5.....140 993 15 26
B3 Dished Plate for 722.4.....201 993 09 26
722.3/722.5 Package of 20 B3 Piston Return Springs.....126 993 27 02
722.4 Package of 20 B3 Piston Return Springs.....123 993 44 01
722.3 Separator Plate.....140 277 14 14
B3 Reverse Delay Kit containing a drill bit, a 10-32 tap, ten 10-32 allen head machine screws and an allen wrench.....Mario Aristides, 305-666-3544

Thanks to Mario Aristides for his technical assistance in compiling this information.

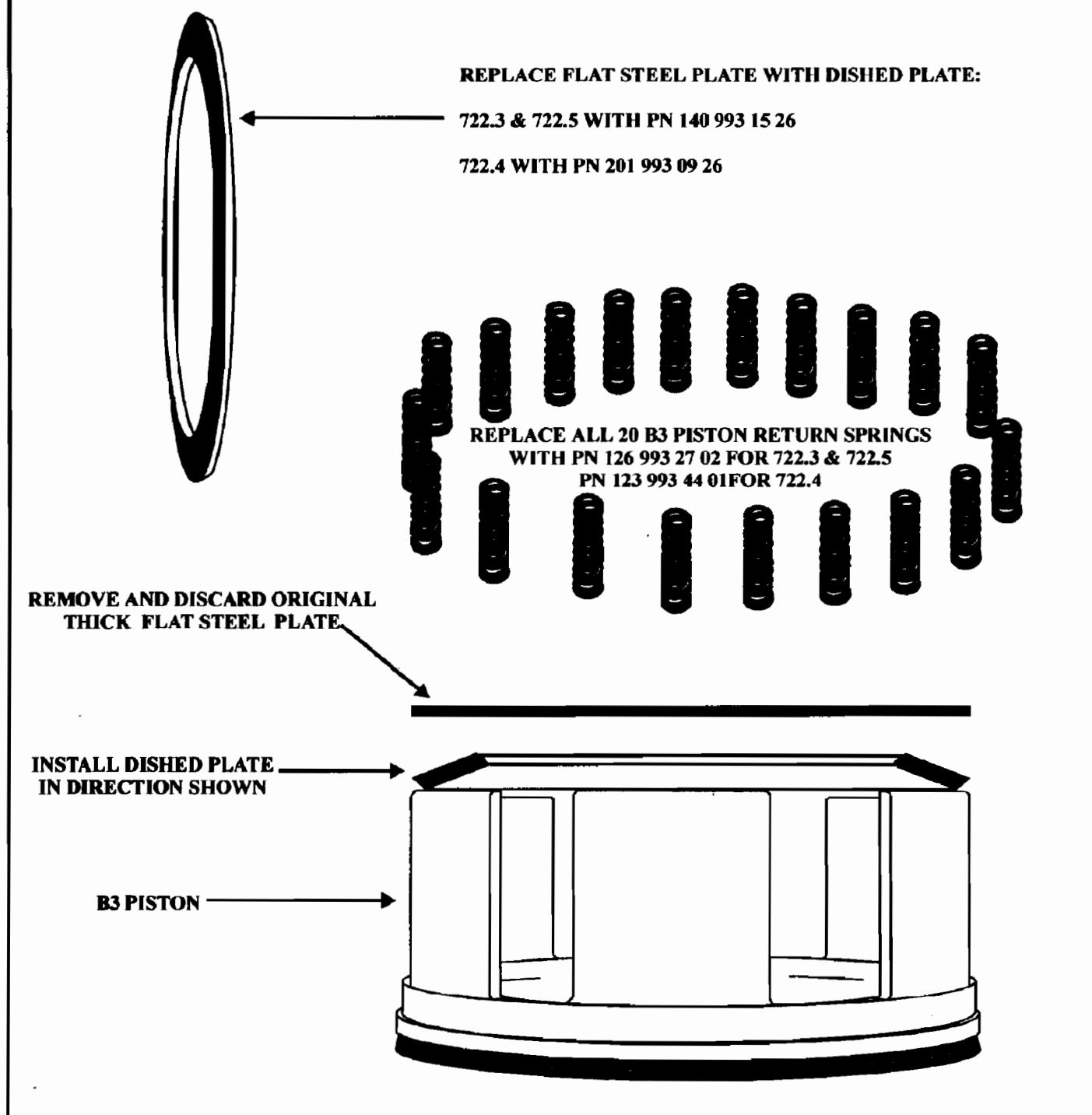
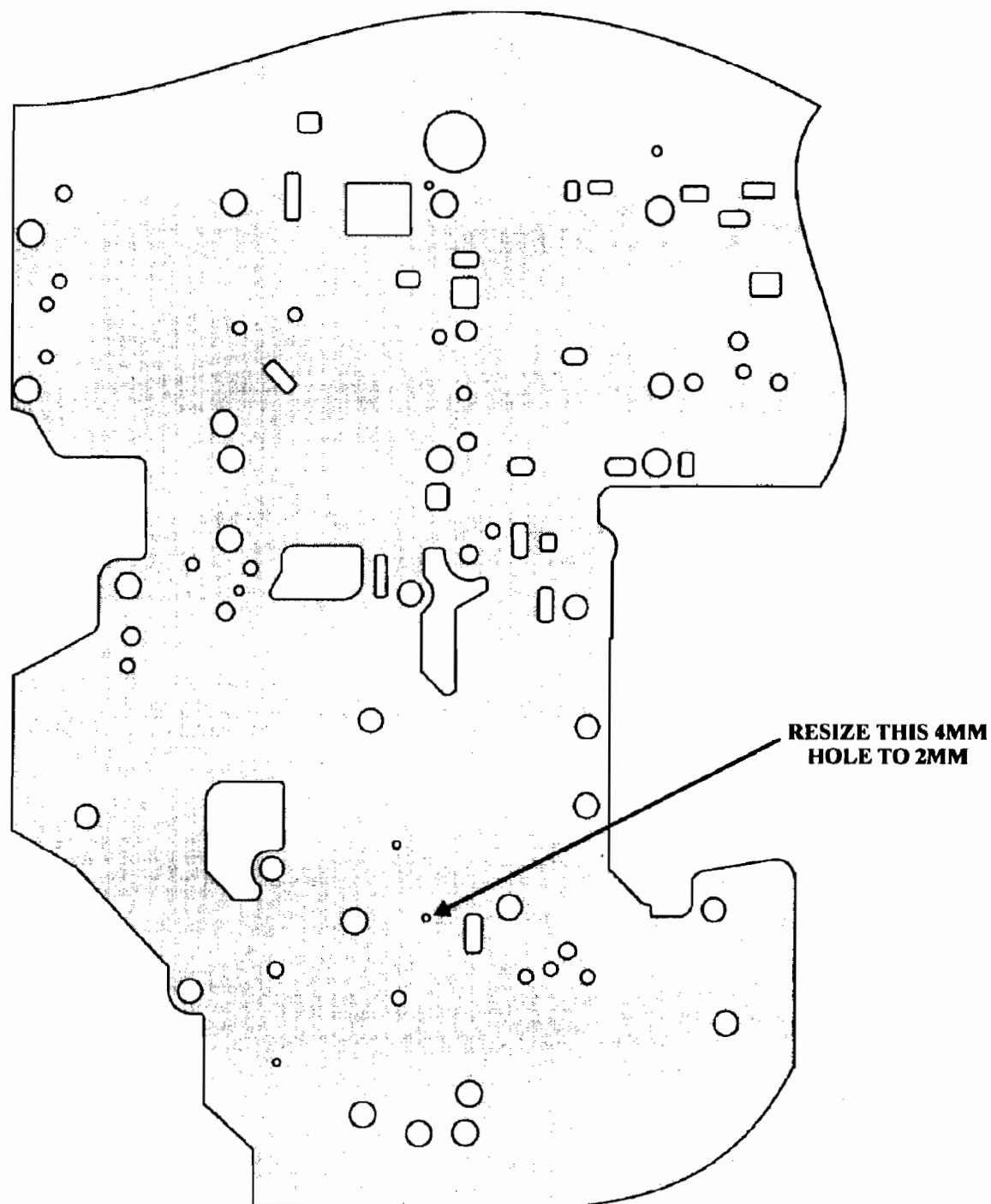
MERCEDES BENZ 722.3, 722.4 & 722.5**REVERSE CONCERNS****722.3, 722.4 & 722.5 HARSH REVERSE ENGAGEMENT**

Figure 1

MERCEDES BENZ 722.3, 722.4 & 722.5**REVERSE CONCERNS****722.5 WITH REAR PUMP ONLY - DELAY IN REVERSE****Figure 2**

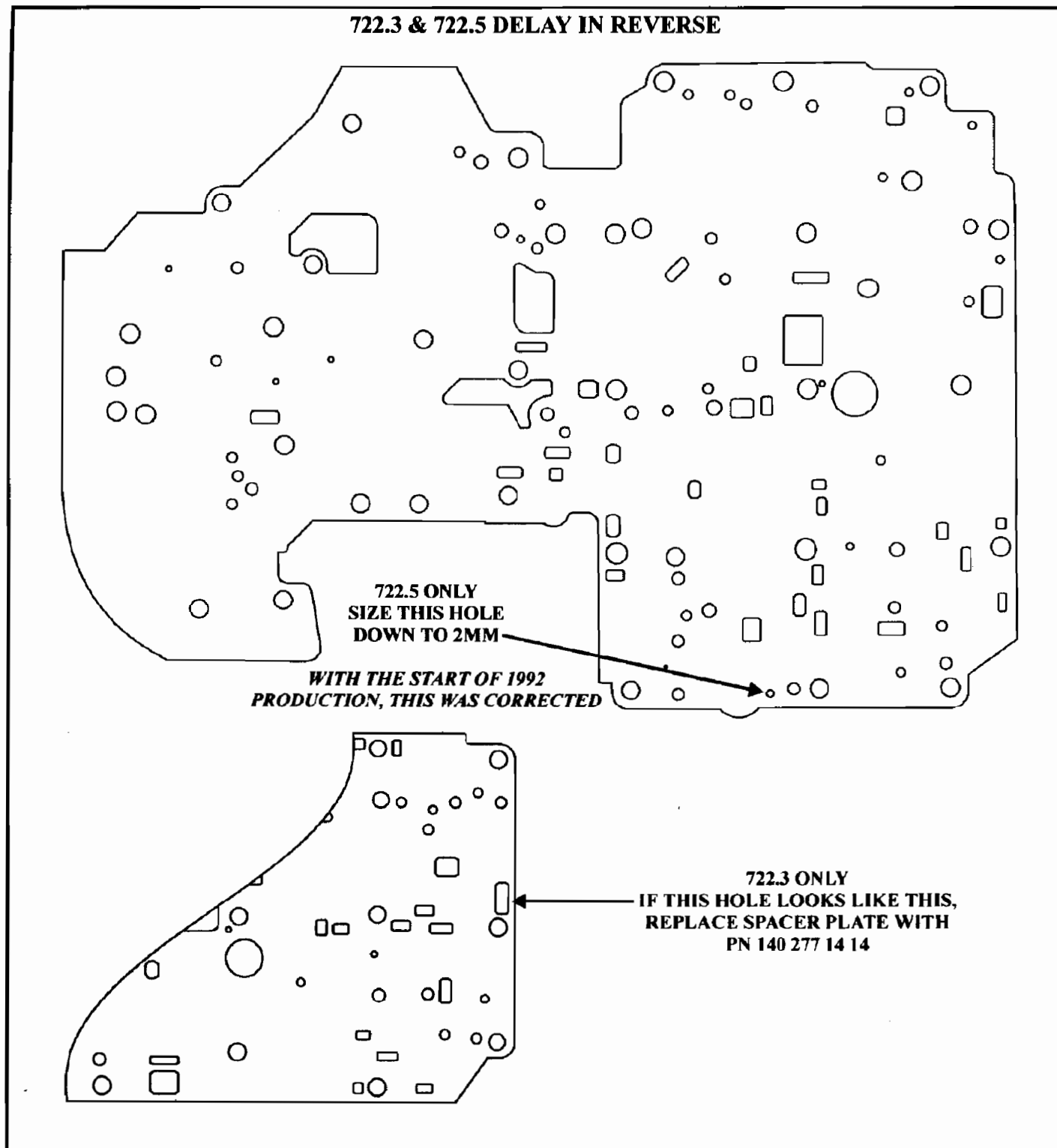
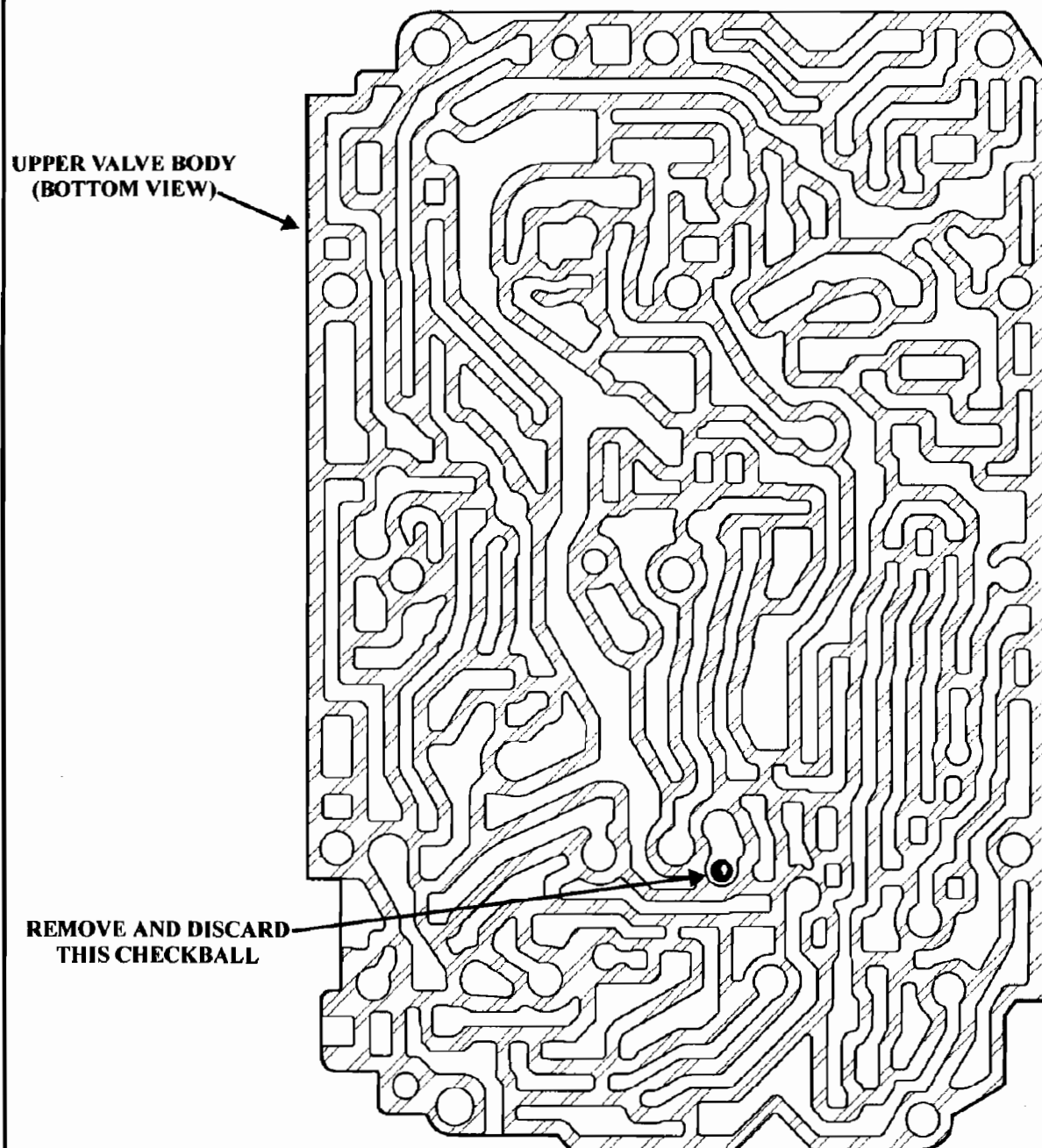
MERCEDES BENZ 722.3, 722.4 & 722.5**REVERSE CONCERNS**

Figure 3

MERCEDES BENZ 722.3, 722.4 & 722.5**REVERSE CONCERNS****722.3 & 722.5 DELAYED REVERSE ENGAGEMENT****Figure 4**

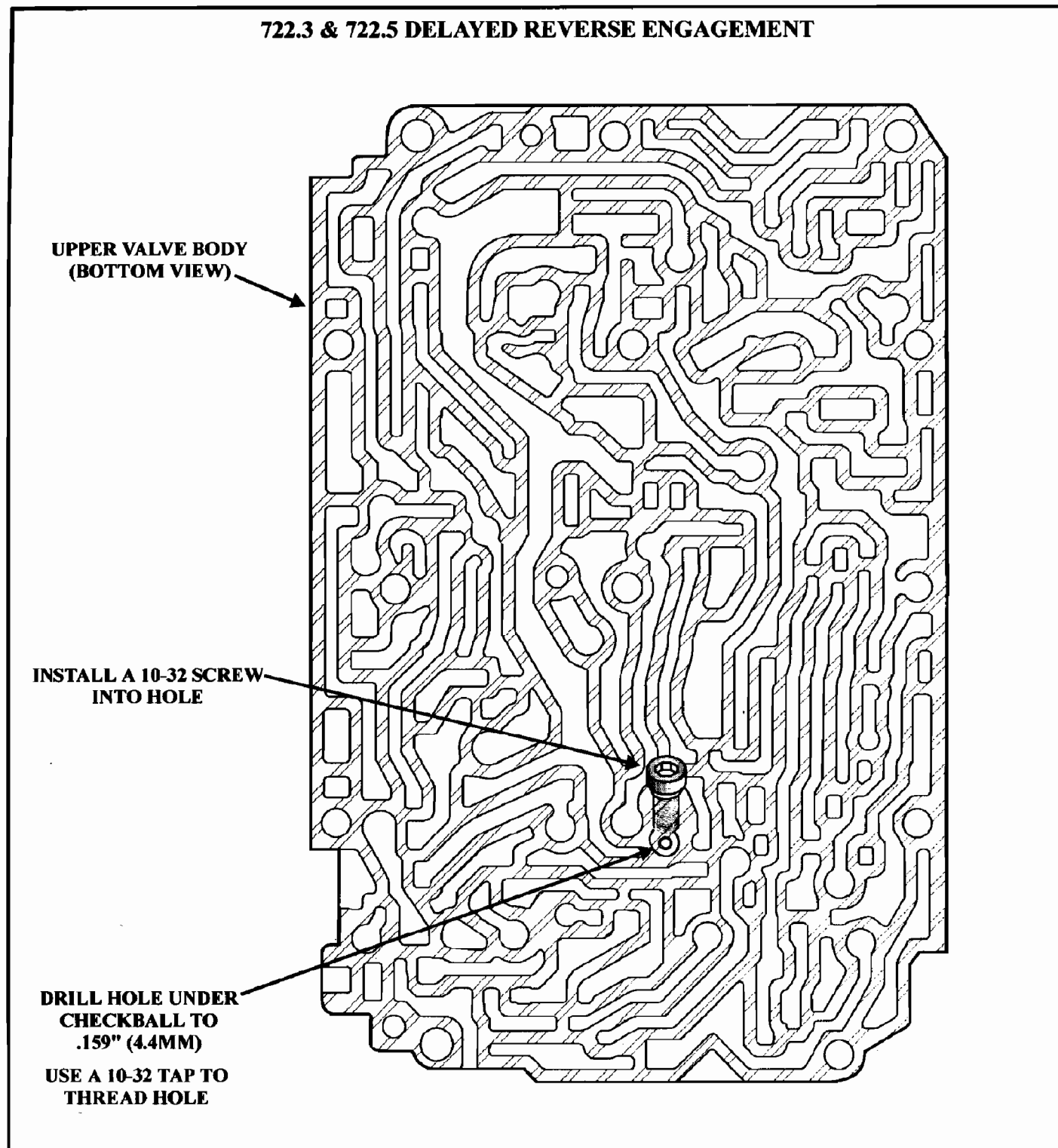
MERCEDES BENZ 722.3, 722.4 & 722.5**REVERSE CONCERNS****722.3 & 722.5 DELAYED REVERSE ENGAGEMENT**

Figure 5



Mitsubishi, Chrysler, Hyundai
KM, F4A, W4A, A4F Units

Stuck in Third Gear

COMPLAINT: No shifts, third gear only, good reverse, "no communications" or possibly "no codes" on scanner.

CAUSE: A few possible causes are Limp mode caused by codes, no power to computer, computer ground problem, or Inhibitor (PRNDL) switch problem.

CORRECTION: The first step towards correcting this problem is confirming the presence or absence of codes by attempting to get codes manually.

Using an analog voltmeter (needle type) or a graphing multimeter (like a Vantage) hook the meter to the pins indicated in figure 1. One of three things will happen:

(1) Any constant signal, including zero.

Follow the "stuck in third" procedure.

(2) Constant ½ second sweeps.

Computer is operating correctly and has no codes stored. Leave the meter connected and verify that you are still stuck in third (or cause the problem to occur). If you are still stuck in third and you still have constant ½ second sweeps, the problem is either in the shift control valve, or both shift solenoids are jammed closed.

(3) Long and short sweeps:

These are the codes. For example, a code 43 would be four long sweeps and three short sweeps. Determine what generation your computer is and consult the code list in figure 4.

NOTE: First generation computers do not use the long followed by short sequence. Match the long/short sequence in the 1st Gen TCM column of figure 4 with the sequence from the computer.

Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Stuck in Third Gear (cont'd)

Stuck in Third Procedure

- (1) Using figure 2, locate the Transmission computer.
- (2) Using the number of jacks and the number of holes where pins could go in each jack in figure 3, identify what generation the computer is. If the computer you are looking at does not match any of the jack configurations in figure 3 it is NOT the transmission computer.
- (3) Using the pinout in figure 3 test the power to the computer.
- (4) Using the pinout in figure 3 test ALL of the grounds to the computer.
- (5) Using the pinout in figure 3 test the Inhibitor (PRNDL) switch wires at the computer: In park the wire for park should have voltage, and the other five should not (Note: check all six). In reverse the wire for reverse should have voltage, and the other five should not (Note: check all six). Repeat for each shifter position.

NOTE: In some cases where you have third gear starts, but you DO have scanner communications, or a no code indication using manual code retrieval, the problem may be just the drive position on the Inhibitor (PRNDL) switch faulting.

If all of these tests are OK, there is an extremely good chance that the computer is bad. The only other thing that could be wrong is the actual jack on the computer. Take a look at the cups in the jack and make sure they are making good contact with the computer pins.

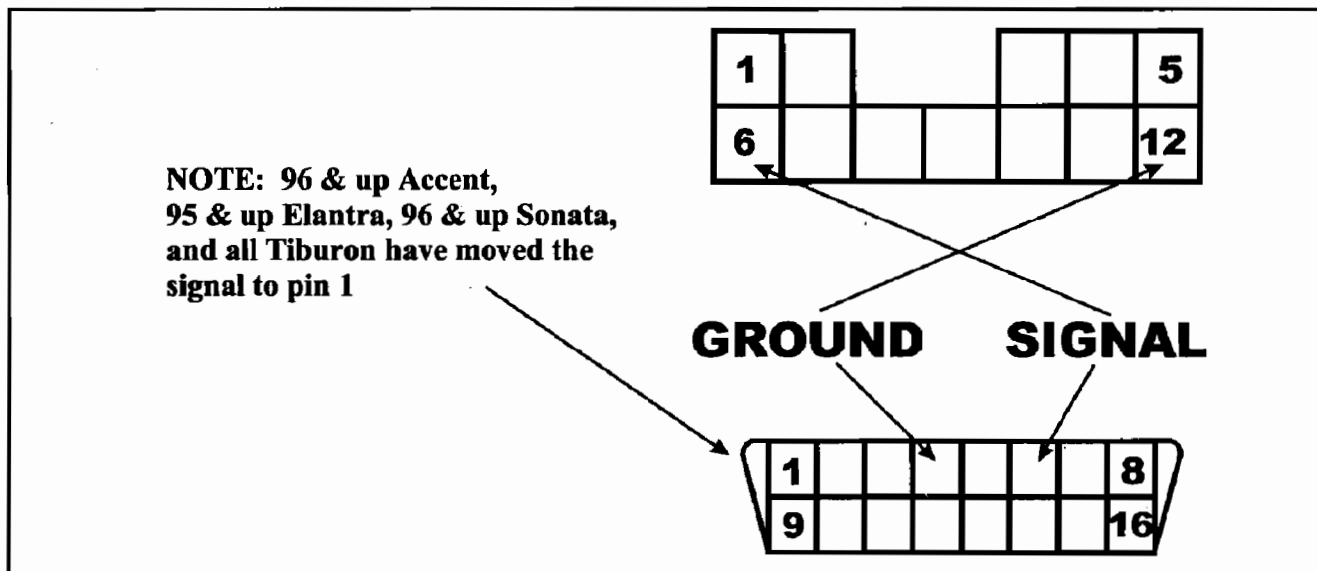
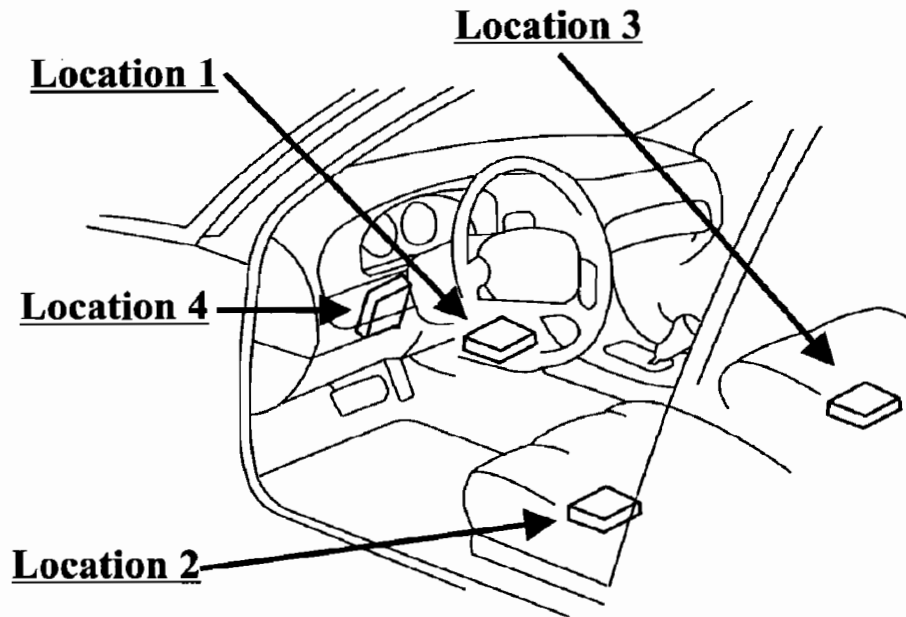


Figure 1

Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Stuck in Third Gear (cont'd)



Location 1: All models except below:

Forward of Console, almost to Firewall, flat on floor. TCM is NOT on edge, it is FLAT.

Location 2: 1994 Scoupe:

Under Driver Seat

Location 3:

1991 to 1993 & 1995 Scoupe

1992 to 1995 Elantra

All years Excel and Precis:

Under Passenger Seat

Location 4:

1993 to 1996 Summit, Summit Wagon

1996 to 1998 Elantra

1995 to 1998 Sonata

All Years Accent & Tiburon:

On Firewall above steering column inside passenger compartment

Figure 2

Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Stuck in Third Gear (cont'd)













1 st Gen TCM	2nd	3rd	4th	Meaning, Check (P0 code)
	21	11	11	TPS Output too high, TPS, Wiring, or adjustment (701)
	22	12	12	TPS Output too low, TPS, Wiring, or adjustment (702)
	23	13	13	TPS Signal out of range, TPS, Wiring, or adjustment (704)
	23	14	14	TPS Signal out of range, TPS, Wiring, or adjustment
	24	15	15	TOT Sensor open, TOT or wiring (712)
	na	16	16	TOT Sensor shorted, TOT or wiring (713)
	na	17	17	HIGH TOT open, TOT or wiring
	25	21	21	Band Servo Switch open, Switch or wiring (709)
	26	22	22	Band Servo Switch shorted, Switch or wiring (709)
	27	23	23	TCM Not receiving Ignition signal, TCM, Ignition system, wiring (727)
	28	24	24	Accelerator Switch open, Switch or wiring (714)
	na	28	28	Stop Lamp Switch shorted, Switch or wiring
	na	31	31	Loss of Pulse Generator A signal, Generator, wiring, EMI, mechanical (717)
	33	32	32	Loss of Pulse Generator B signal, Generator, wiring, EMI, mechanical (722)
	31	na	na	Malfunction of TCM, Replace TCM
	32	na	na	Malfunction of TCM: First gear commanded at high speed, Replace TCM
	41	41	41	SS-A Open, Solenoid, wiring (752)
	42	42	42	SS-A Shorted, Solenoid, wiring (753)
	43	43	43	SS-B Open, Solenoid, wiring (757)
	44	44	44	SS-B Shorted, Solenoid, wiring (758)
	45	45	45	EPC Solenoid Open, Solenoid, wiring (747)
	46	46	46	EPC Solenoid Shorted, Solenoid, wiring (748)
	47	47	47	TCC Solenoid Open, Solenoid, wiring
	48	48	48	TCC Solenoid Shorted, Solenoid, wiring
	49	49	49	Lockup Problem, Hydraulic, Mechanical (740, 742, 743, 744)
	51	51	51	Wrong Ratio or slip in First, Hydraulic, Mechanical, Pulse Generator (731)
	52	52	52	Wrong Ratio or slip in Second, Hydraulic, Mechanical, Pulse Generator (732)
	53	53	53	Wrong Ratio or slip in Third, Hydraulic, Mechanical, Pulse Generator (733)
	54	54	54	Wrong Ratio or slip in Fourth, Hydraulic, Mechanical, Pulse Generator (734)
	na	59	59	Lockup chatter detected, Hydraulic
	na	61	61	Torque Reduction Request line, ECM, TCM, Wiring
	na	62	62	Torque Reduction Request line shorted, ECM, TCM, Wiring
	na	63	63	Torque Reduction Request line open, ECM, TCM, Wiring
	11	81	81	Limp mode caused by code 31
	12	82	82	Limp mode caused by code 32
	13	na	na	Limp mode caused by code 33
	14	83	83	Limp mode caused by code 41, 42
	15	84	84	Limp mode caused by code 43, 44
	16	85	85	Limp mode caused by code 45, 46
	17	86	86	Limp mode caused by code 51, 52, 53, 54
				SSA Not following computer command, Solenoid, hydraulic
				SSB Not following computer command, Solenoid, hydraulic
				Band Servo Switch malfunction, Switch or wiring
				Slip detected, see codes 51 to 54
				EPC Not following computer command, Solenoid, hydraulic
				Engine RPM over 6500, RPM Signal
				Sun Shell RPM over 6500, Pulse Generator

Figure 4

PERFORMANCE STANDARD

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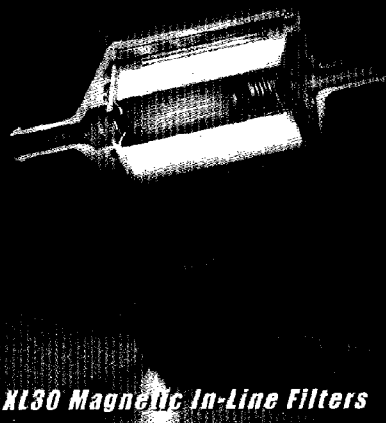
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Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Electrical System Elements

COMPLAINT: Confusion or incorrect troubleshooting methods for electrical problems

CAUSE: Incorrect assumptions about various electrical system components

CORRECTION: Review the table in Figures 1, 2, and 3 to determine the correct electrical elements for the vehicle. See figure 4 for Transmission Control Module (TCM) Locations and Idle Position Switch (IPS) Type.

Chrysler												
Model	Year	TCM Generation	TCM Location	TCM Fuse #	DLC Pin #	IPS Type	TOT Wires	SS1 Color	SS2 Color	TCC Color	EPC Color	Notes
Colt	90	2	1	4	6	Aps	2	Org	Yel	Red	Blu	
	91-92	3	1	7	6	Aps	2	Yel	Org	Red	Blu	
	93-96	4	1	17	6	Tps	2	Yel	Org	Red	Blu	
Colt Vista	91-92	3	1	7	6	Aps	3	Org	Yel	Red	Blu	
	93-94	4	1	7	6	Tps	2	Org	Yel	Red	Blu	
Eagle Summit	89-90	2	1	4	6	Aps	2	Org	Yel	Red	Blu	
	91-92	3	1	7	6	Aps	2	Org	Yel	Red	Blu	
	93-96	4	1	17	6	Tps	2	Org	Yel	Red	Blu	
Laser & Talon	90	2	1	6	6	Aps	2	Yel	Org	Red	Blu	
	91-93	3	1	7	6	Aps	Turbo-3 Non-tb-2	Org	Yel/blu	Red	Blu	
	94	4	1	7	6	Aps	2	Org	Yel/blu	Red	Blu	
	95-98	4	1	15	6	Tps	2	Gry	Org	Red	Blu/yel	
Stealth	91-92	3	1	7	6	Aps	3	Gry	Org	Red	Blu/yel	
	93-96	4	1	7	6	Tps	2	Gry	Org	Red	Blu/yel	
Summit Wagon	91-92	3	1	7	6	Aps	3	Org	Yel	Red	Blu	
	93-96	4	1	7	6	Tps	2	Org	Yel	Red	Blu	

Figure 1

Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Electrical System Elements

Mitsubishi												
Model	Year	TCM Generation	TCM Location	TCM Fuse #	DLC Pin #	IPS Type	TOT Wires	SS1 Color	SS2 Color	TCC Color	EPC Color	Notes
3000GT	91-92	3	1	7	6	Aps	3	Gry	Org	Red	Blu/yel	
	93-98	4	1	7	6	Tps	2	Gry	Org	Red	Blu/yel	
Diamonte	92	3	1	8	6	Tps	3	Org	Yel	Red	Blu	
	93-96	4	1	7	6	Tps	2	Org	Yel	Red	Blu	
Eclipse	90	2	1	6	6	Aps	2	Yel	Org	Red	Blu	
	91-92	3	1	7	6	Aps	Turbo-3 Nontb-2	Org	Yel/blu	Red	Blu	
	93-94	4	1	7	6	Aps	2	Org	Yel/blu	Red	Blu	
	95-96	4	1	15	6	Tps	2	Gry	Org	Red	Blu/yel	
Expo	92	3	1	7	6	Aps	AWD-3 FWD-2	Org	Yel	Red	Blu	
	93-96	4	1	7	6	Tps	2	Org	Yel	Red	Blu	
Galant	85-89	1	1	11	6	Aps	2	Org	Yel	Red	Blu	
	89-90	2	1	6	6	Aps	2	Org	Yel	Red	Blu	
	91-92	3	1	6	6	Aps	AWD-3 FWD-2	Org	Yel	Red	Blu	
	93-98	4	1	15	6	Tps	2	Org	Yel	Red	Blu	
Sigma	89	1	1	11	6	Aps	2	Org	Yel/blu	N/A	Blu	
	90	2	1	11	6	Aps	2	Org	Yel/blu	N/A	Blu	
Mirage	90	2	1	4	6	Aps	2	Org	Yel	Red	Blu	
	91-92	3	1	4	6	Aps	2	Org	Yel/wht	Red	Blu	
	93-96	4	1	17	6	Tps	2	Yel	Org	Red	Blu	
Precis	90-92	2	3	10	6	Aps	2	Blu/bl	Red	Blu	Yel	
	93	2	3	10	6	Aps	2	Blu/bl	Red	Blu	Yel	
	94	3	3	10	6	Isr	3	Red	Blu/blk	Blu	Yel	

Figure 2

Mitsubishi, Chrysler, Hyundai

KM, F4A, W4A, A4F Units

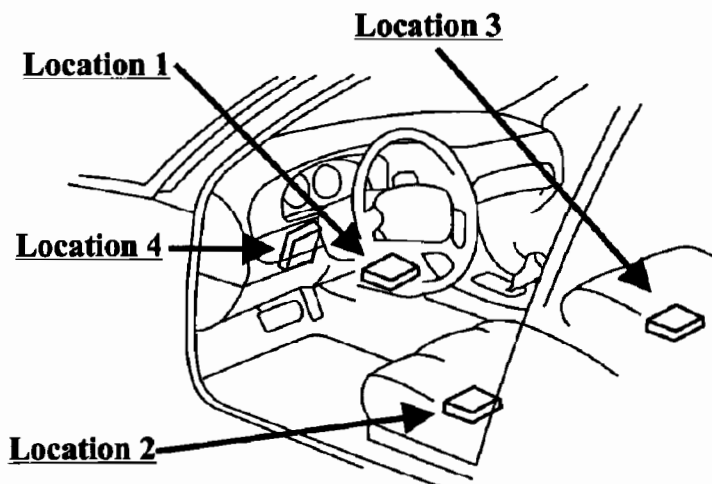
Electrical System Elements

Hyundai												
Model	Year	TCM Generation	TCM Location	TCM Fuse #	DLC Pin #	IPS Type	TOT Wires	SS1 Color	SS2 Color	TCC Color	EPC Color	Notes
Accent	95	4	4	15	6	Isc	2	Blu/blk	Red	Blu/yel	Yel	
	96-97	4	4	9	1	Isc	2	Blu/blk	Red	Blu/yel	Yel	
	98	4	4	9	1	Isc	2	Blu	Red	Blu/yel	Yel	
Elantra	92	2	3	13	6	Aps	2	Blu/blk	Red	Blu	Yel	
	93	2	3	13	6	Aps	2	Blu/blk	Red	Blu/yel	Yel	
	94	3	3	13	6	Isc	3	Blu/blk	Red	Blu/yel	Yel	
	95	4	3	22	1	Tps	2	Org	Yel	Red	Blu	
	96-98	4	4	9	1	Isc	2	Blu/blk	Red	Blu/yel	Yel	
Excel	90-92	2	3	10	6	Aps	2	Blu/blk	Red	Blu	Yel	
	93	2	3	10	6	Aps	2	Blu/blk	Red	Blu	Yel	
	94	3	3	10	6	Isc	3	Red	Blu/blk	Blu	Yel	
Scoupe	91-93	2	3	9	6	Aps	2	Blu/blk	Red	Blu/yel	Yel	Before 7/1/93
	94	3	2	9	6	N/A	3	Blu/blk	Red	Blu/yel	Yel	93 after 7/1/93
	95	3	3	9	6	Aps	3	Blu/blk	Red	Blu/yel	Yel	
Sonata	89	2	1	15	6	Aps	2	Org	Yel/wht	Red/wht	Blu	
	90	2	1	15	6	Aps	2	Org	Yel/wht	N/A	Blu	
	91	2	1	15	6	Aps	2	Org	Yel/wht	Red/wht	Blu	
	92	2	1	11	6	Aps	2	Org	Yel/wht	Red/wht	Blu	
	93-94	2	1	15	6	Aps	2	Org	Yel/wht	Red/wht	Blu	4 cyl
	93	2	1	15	6	Aps	2	Org	Yel/wht	Red/wht	Blu	V6
	94	3	1	15	6	Aps	2	Org	Yel/wht	N/A	Blu	V6
	95	3	1	22	6	Isc	3	Blu/blk	Red	Blu	Yel	2.0L
	95	4	1	22	6	Tps	2	Org	Yel/wht	Red/wht	Blu	3.0L
	96	4	1	13	6	Isc	2	Blu/blk	Red	Blu	Yel	2.0L
	96	4	1	22	1	Tps	2	Org	Yel/wht	Red/wht	Blu	3.0L
	97	4	1	22	1	Tps	2	Blu/blk	Red	Blu	Yel	2.0L
	97	4	1	22	1	Tps	2	Org	Yel/wht	Red/wht	Blu	3.0L
	98	4	1	22	1	Tps	2	Blu/blk	Red	Blu	Yel	2.0L
	96-98	4	1	22	1	Tps	2	Org	Yel/wht	Red/wht	Blu	3.0L
Tiburon		4	4	9	1	Isc	2	Blu/bl	Red	Blu/yel	Yel	

Figure 3

Mitsubishi, Chrysler, Hyundai KM, F4A, W4A, A4F Units

Electrical System Elements



Location 1: All models except below:

Forward of Console, almost to Firewall, flat on floor. TCM is NOT on edge, it is FLAT.

Location 2: 1994 Scoupe:

Under Driver Seat

Location 3:

1991 to 1993 & 1995 Scoupe

1992 to 1995 Elantra

All years Excel and Precis:

Under Passenger Seat

Location 4:

1993 to 1996 Summit, Summit Wagon

1996 to 1998 Elantra

1995 to 1998 Sonata

All Years Accent & Tiburon:

On Firewall above steering column inside passenger compartment

IPS Type:

Aps = Accelerator Pedal Switch, on bracket above accelerator pedal

Tps = Built in to 4 wire TPS

Isc = Bullet switch near the Idle Speed Controller on Throttle Body

Figure 4



NISSAN RE4FO4A OR VILLAGER 4F20E
SLIPPING OR NO 2ND GEAR

COMPLAINT: Before and/or after rebuild, the vehicle exhibits a condition of no upshift into second gear, or a slipping condition into 2nd gear.

CAUSE NO. 1: One cause may be insufficient spring tension on the 1-2 accumulator piston, or a stuck 1-2 accumulator regulator valve allowing 2nd apply oil to be restricted. Refer to Figure 1, for a description of the 1-2 hydraulic circuit with a stuck valve, or insufficient spring tension on the 1-2 accumulator piston. Refer to Figure 2, for a description of the 1-2 hydraulic circuit with sufficient spring tension on the 1-2 accumulator piston.

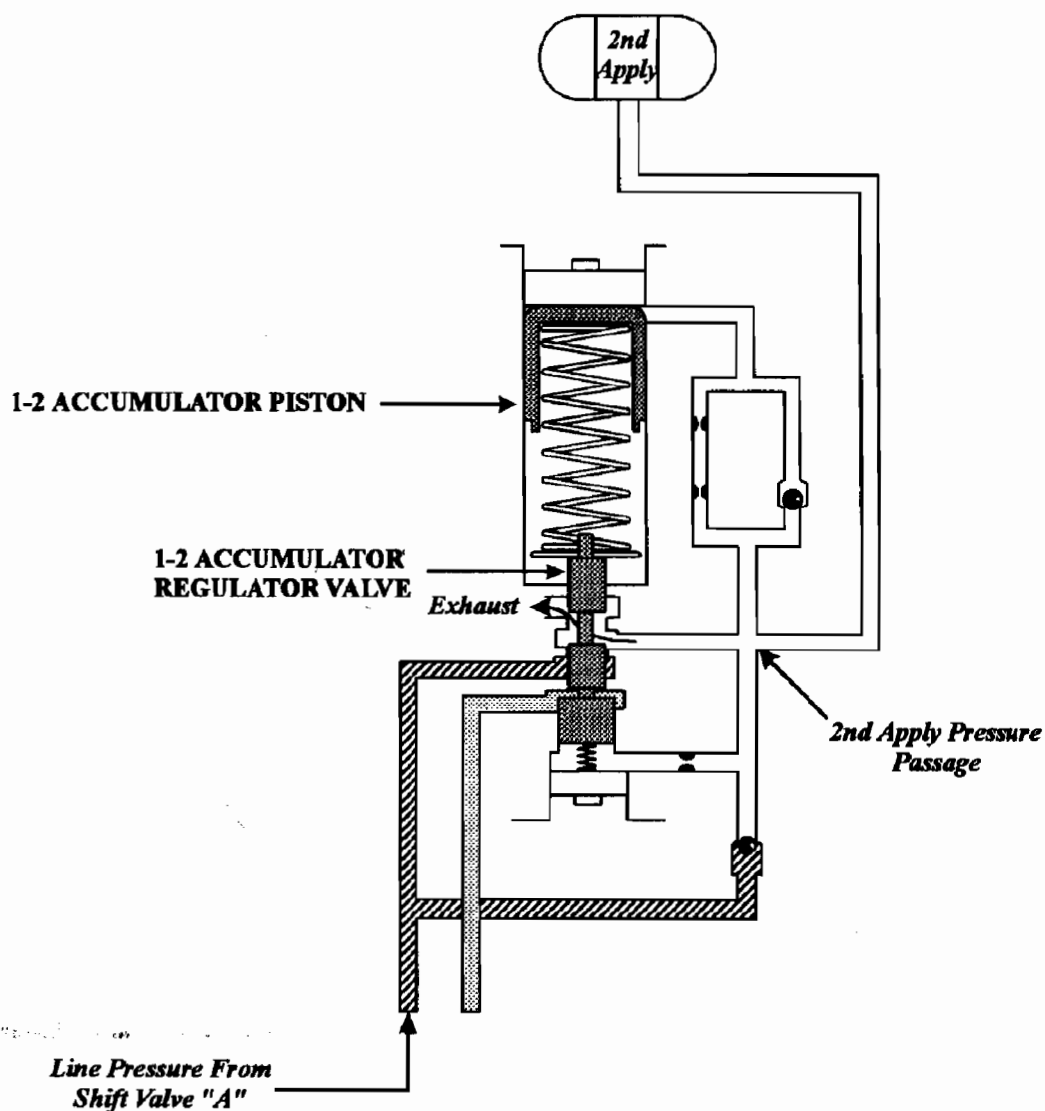
CAUSE NO. 2: Another cause may be the 2/4 servo return spring switched with the N/D accumulator spring. If the N/D accumulator spring is installed in the location for the 2/4 servo return spring, the N/D accumulator spring will coil bind before the 2/4 servo gets a chance to fully apply the band resulting in a no second gear condition. Refer to Figure 5 for spring specifications and proper placement of the 2-4 servo return spring and the N-D accumulator spring.

CORRECTION NO. 1: Add a pressure regulator valve spring from a 700-R4 inside of the original 1-2 accumulator spring as shown in Figure 3. Install a 1.5 - 2.0 pound heavier spring in the Pilot Valve line-up, as shown in Figure 3. Also install two 125C front planetary shims on the Pressure Regulator Valve, to increase line pressure, as shown in Figure 4. This will greatly increase transmission durability and reliability.

CORRECTION NO. 2: Refer to Figure 5 for spring specifications and place the 2-4 servo return spring and the N-D accumulator spring in their proper locations.

"NO" SECOND GEAR APPLY

If the 1-2 accumulator regulator valve is stuck as shown here, line pressure cannot pass through the valve and apply the servo. In addition, If the spring for the accumulator piston is too weak, 2nd apply pressure may allow the accumulator regulator valve to stroke toward the piston, and block oil coming from shift valve "A" allowing all apply oil to exhaust through the valve as shown by the arrow.

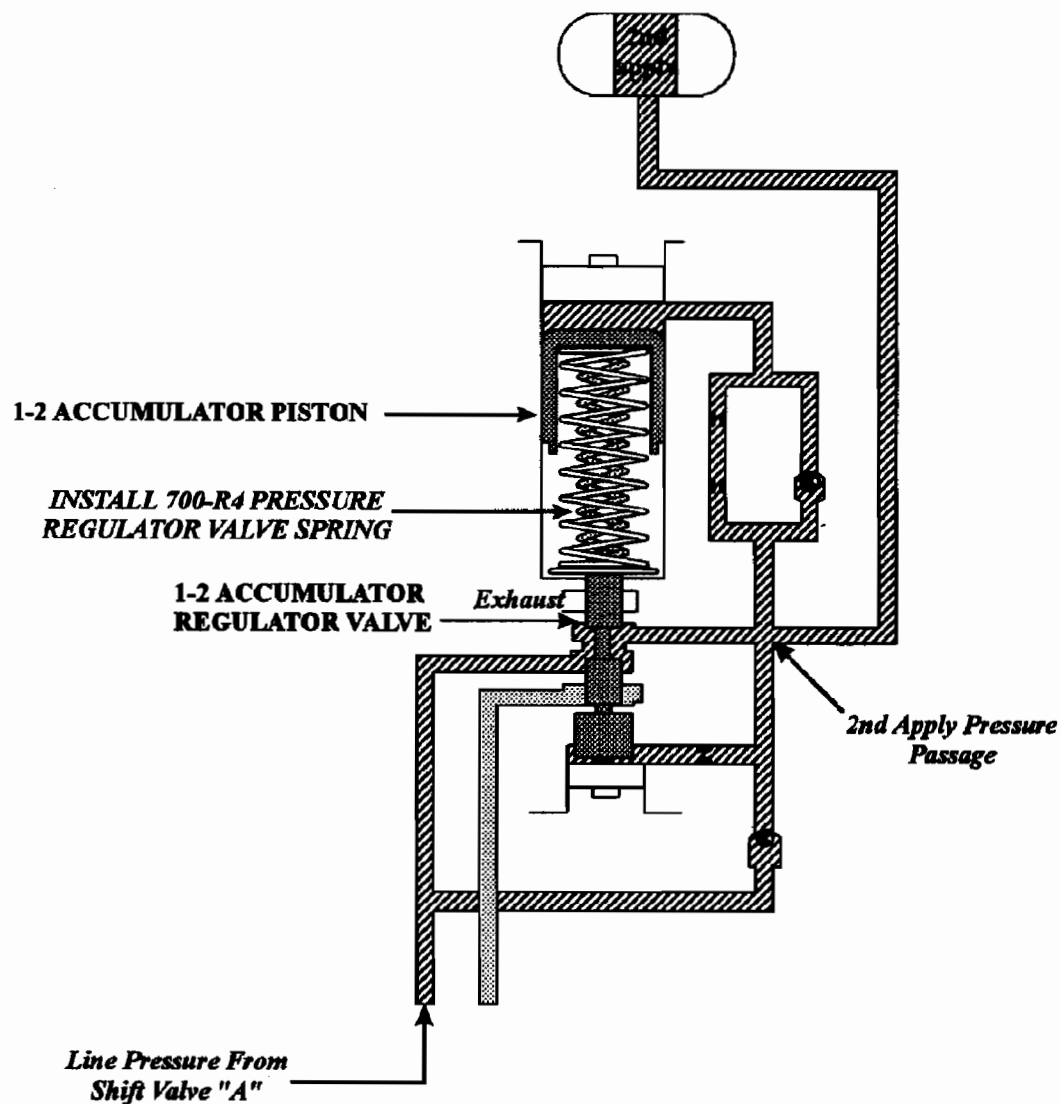


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Figure 1

"GOOD" SECOND GEAR APPLY

With a 700-R4 pressure regulator valve spring installed inside the original 1-2 accumulator spring, the 1-2 accumulator regulator valve remains in the proper position (exhaust closed) and allows line pressure to flow to the 2nd apply side of the servo.



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Figure 2

We've just added something extremely valuable to our kits.

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For 25 years, Precision International has manufactured foreign and domestic gasket kits, seal-up, transfer case, overhaul and master kits to the highest standards. Before we send a kit out to market, we tear apart the transmission it goes into to make sure every single part fits the way it should. This assures that you get the best, most complete, kits available. What's more, every

Precision kit comes complete with installation tips and easy-to-follow instructions. So you can do the job right the first time, all the time. Plus, our inventory control procedures have made us a leader in on-time delivery to distributors all over the world. This kind of attention to detail has earned us something very few kit manufacturers can boast of — registration by Underwriter's Laboratories to ISO 9002 — a system of quality standards for manufacturing, products and services for business and industry. So next time you're looking for OE certified foreign or domestic transmission repair kits, you can

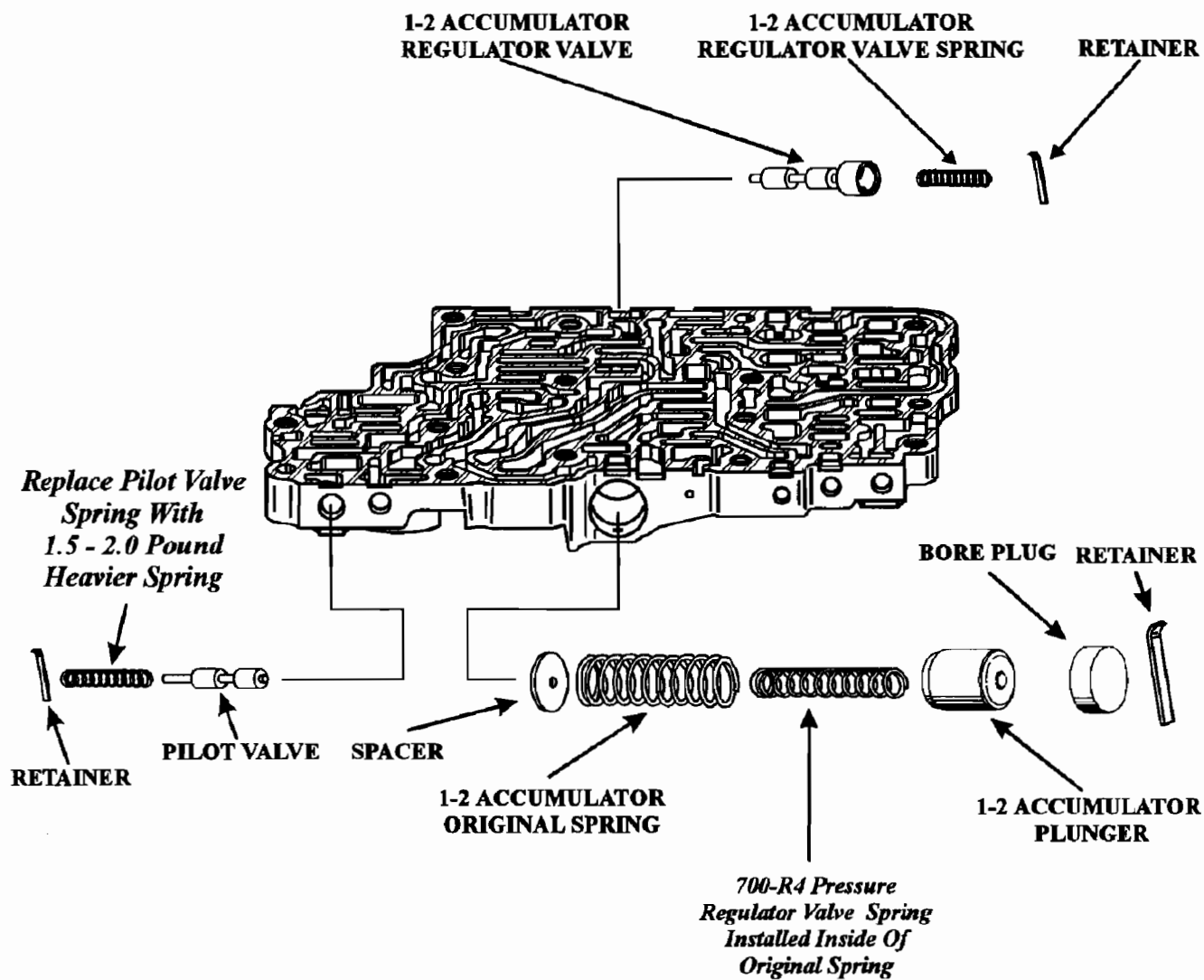
PRECISION

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count on Precision to deliver quality, time and time again.

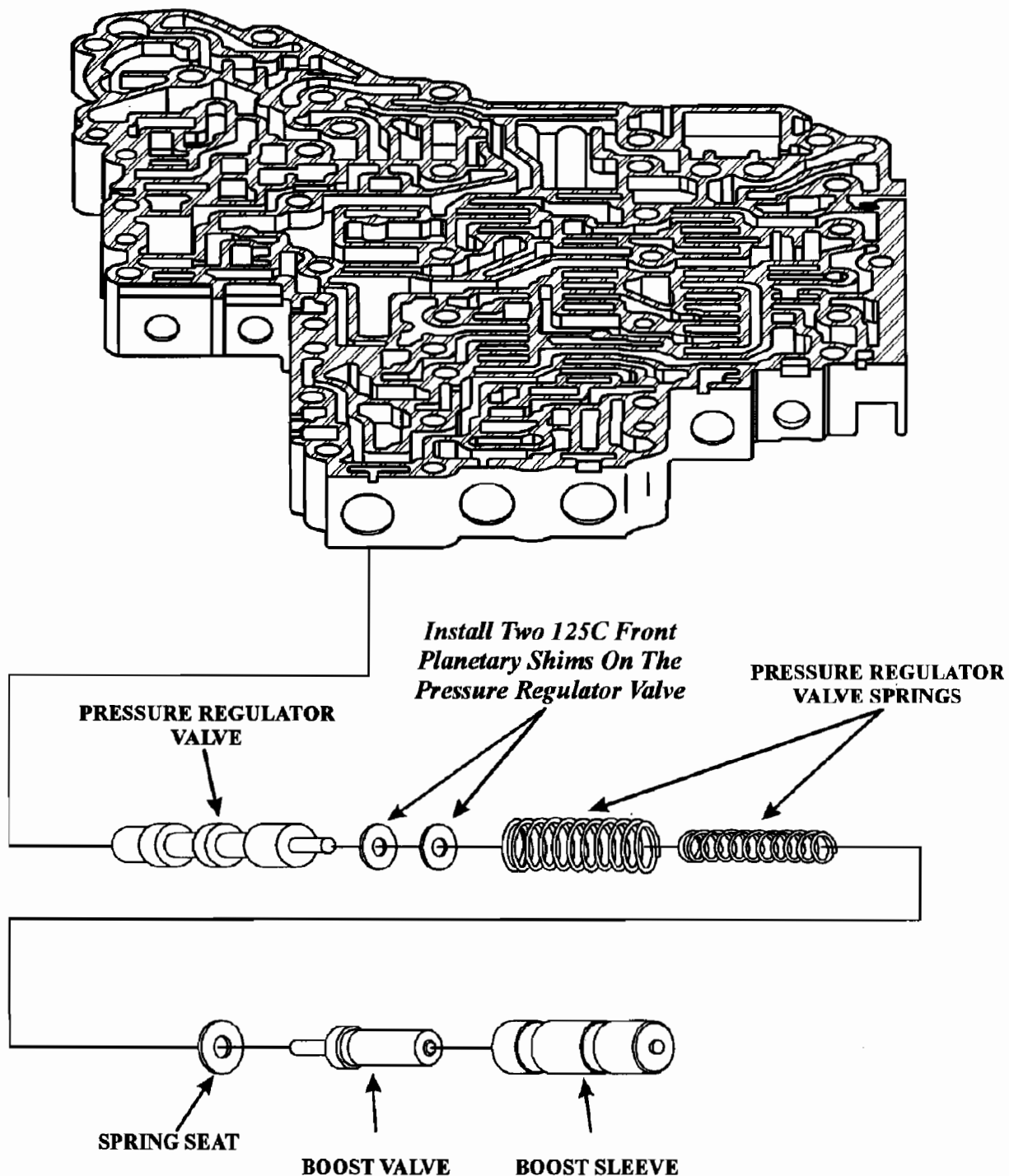
RECOMMENDED MODIFICATIONS



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Figure 3

RECOMMENDED MODIFICATIONS



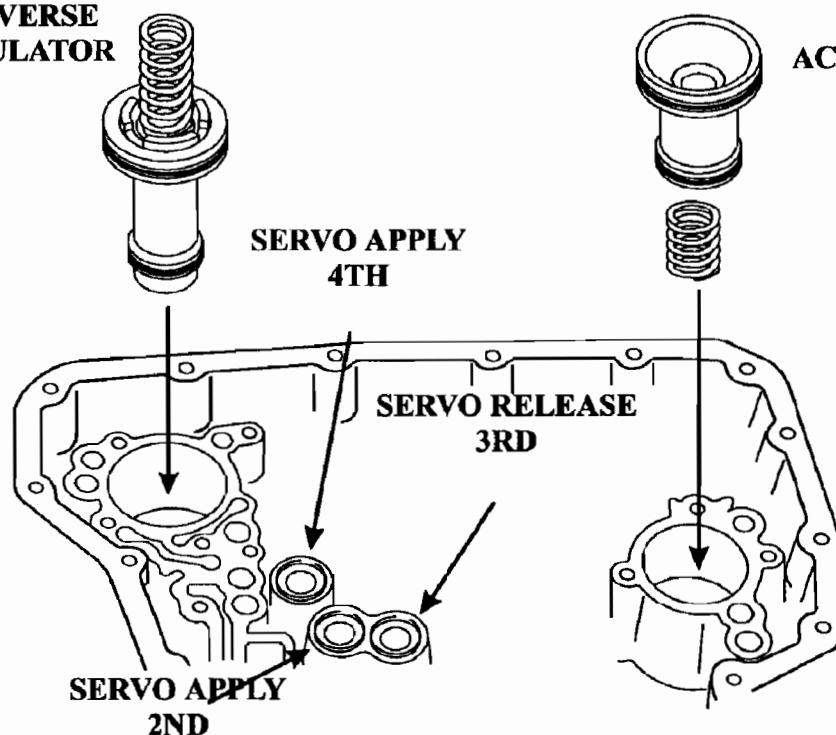
Copyright © 2000 ATSG

Figure 4

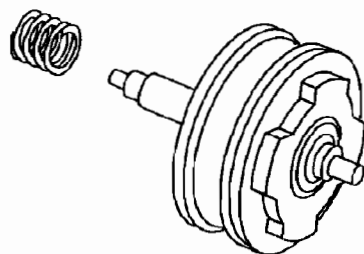
ACCUMULATOR SPRING IDENTIFICATION AND PROPER LOCATIONS

**3RD/REVERSE
ACCUMULATOR**

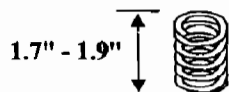
**N/D
ACCUMULATOR**



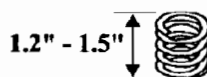
**2ND/4TH SERVO
PISTON ASSEMBLY**



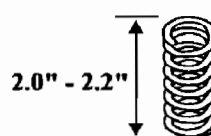
**THE N/D ACCUMULATOR
SPRING IS APPROX. 1.7" TO 1.9"**



**THE 2ND/4TH SERVO
SPRING IS APPROX. 1.2" TO 1.5"**



**THE 3RD/REVERSE ACCUMULATOR
SPRING IS APPROX. 2.0" TO 2.2"**



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Figure 5

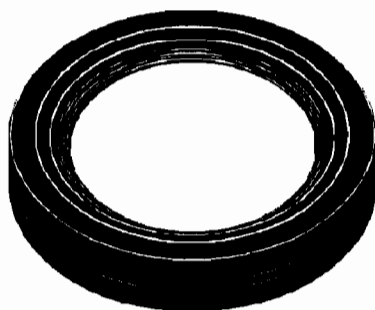
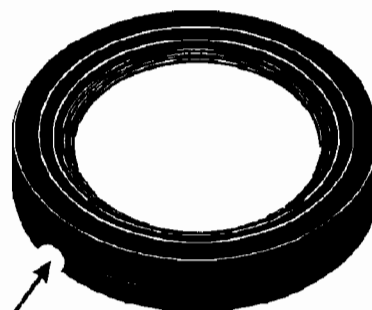


NISSAN MAXIMA RE4FO2A
REPEATED FRONT SEAL LEAK

COMPLAINT: Before and/or after rebuild, vehicle exhibits a condition of a repeated front seal leak. The front seal may appear to have popped out of the converter housing.

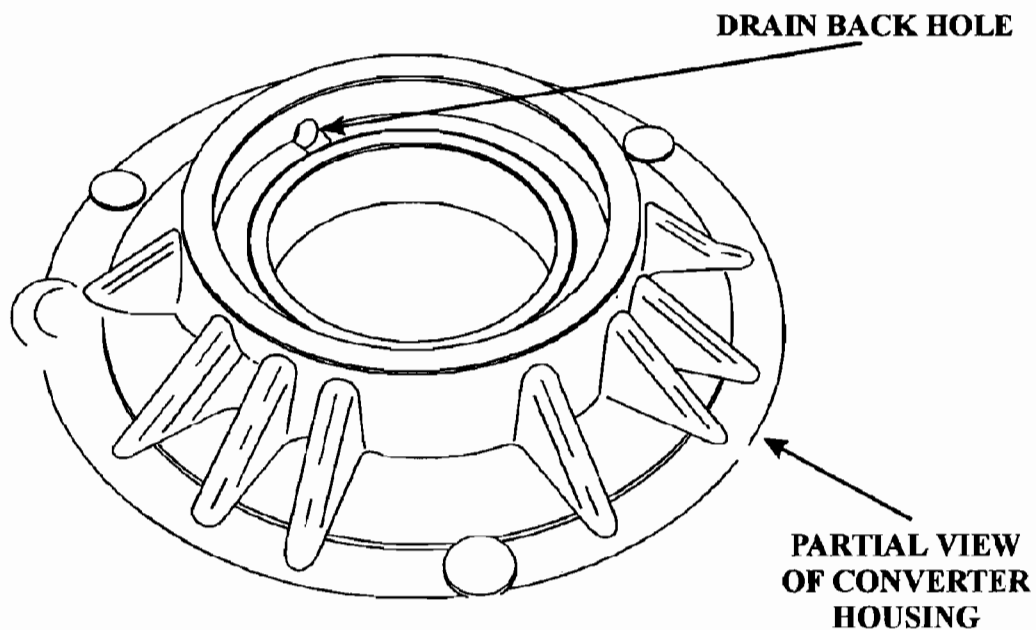
CAUSE: One cause may be that during the rebuild procedure the front pump seal was installed too deeply into the converter housing. When this happens, the seal will block off approximately half of the drain back hole in the pump causing an increase of oil pressure behind the seal. Due to the increased pressure, the front seal may either pop out of the converter housing, or oil may blow past the seal between the seal lip and the converter hub.

CORRECTION: To correct the problem use a die grinder and cut a round notch into the seal approximately the same size as the drain back hole, then index the seal into the converter housing lining up the notch that you just cut, with the drain back hole. Refer to Figure 1 for location of the drain back hole in the converter housing and location of round notch in seal. It has been ATSG's experience that OEM seals have a better retention rate than some of the aftermarket seals.

**SEAL WITHOUT
ROUND NOTCH****SEAL WITH
ROUND NOTCH**

INSTALLING A NEW SEAL TOO DEEPLY INTO THE CONVERTER HOUSING WILL BLOCK ABOUT HALF OF THE DRAIN BACK HOLE IN THE SEAL AREA, WHICH COULD CREATE EXCESS PRESSURE BEHIND THE SEAL CAUSING THE SEAL TO WALK OUT OF THE PUMP.

USE A DIE GRINDER AND CUT A NOTCH INTO THE SEAL AS SHOWN ABOVE. NEXT INDEX THE NOTCHED CUT OUT OVER THE DRAIN BACK HOLE IN THE CONVERTER HOUSING WHEN INSTALLING THE SEAL.



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Figure 1

Some see this as scrap metal.

***We see it as lost profits
for your shop!***



We understand your business and realize that life in today's transmission shop is no picnic. Some days it seems like nothing goes your way. Units are more complicated, plus parts cost and general overhead keep rising. Profits off each job seem to remain the same.

What do you do?

We recommend that you turn those extra pumps, drums, and planet cores into the profits you've been missing! For example, we can R&R your rebuildable 4L80E Pumps and save your shop \$146 on each pump. No, not all savings are this great, but you would be surprised how quickly our R&R Service can add profits to your bottom line.

Call us today and ask about our Free R&R Pick-up Service.

Send your e-mail to
WITtransparts@aol.com



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"We Understand Your Business and It Shows!"

TOYOTA PREVIA A46DE

STACKED SHIFTS/NO PASSING GEAR

COMPLAINT: Before or after overhaul, some Toyota Previas equipped with 4 cyl. engines and A46DE transmissions, may exhibit stacked shifts and no passing gear.

CAUSE: The cause may be, a broken wiring harness at the Throttle Position Sensor Connector or a break in the harness from the Throttle Position Sensor where it enters a protective cover as shown in Figure 2, or a faulty Throttle Position Sensor.

CORRECTION: Refer to Figure 1 to test the Throttle Position Sensor Diagnostic Voltage output at the Diagnostic connector as shown in Figure 1. Locate the break in the harness as shown in Figure 2. If the wires are broken where the harness enters the protective cover, add some length, with some new wire, to the harness and reconnect the harness. If the wires are broken at the connector, where they can not be repaired, replace the connector with a TPS connector with 7 or 8 inches of the harness from a 1.8 L Tercel engine from a salvage yard or a new upper wire harness for the whole upper engine can be purchased from Toyota. If the wire harness is good test the Throttle Position Sensor as shown in Figure 3 and replace as necessary.

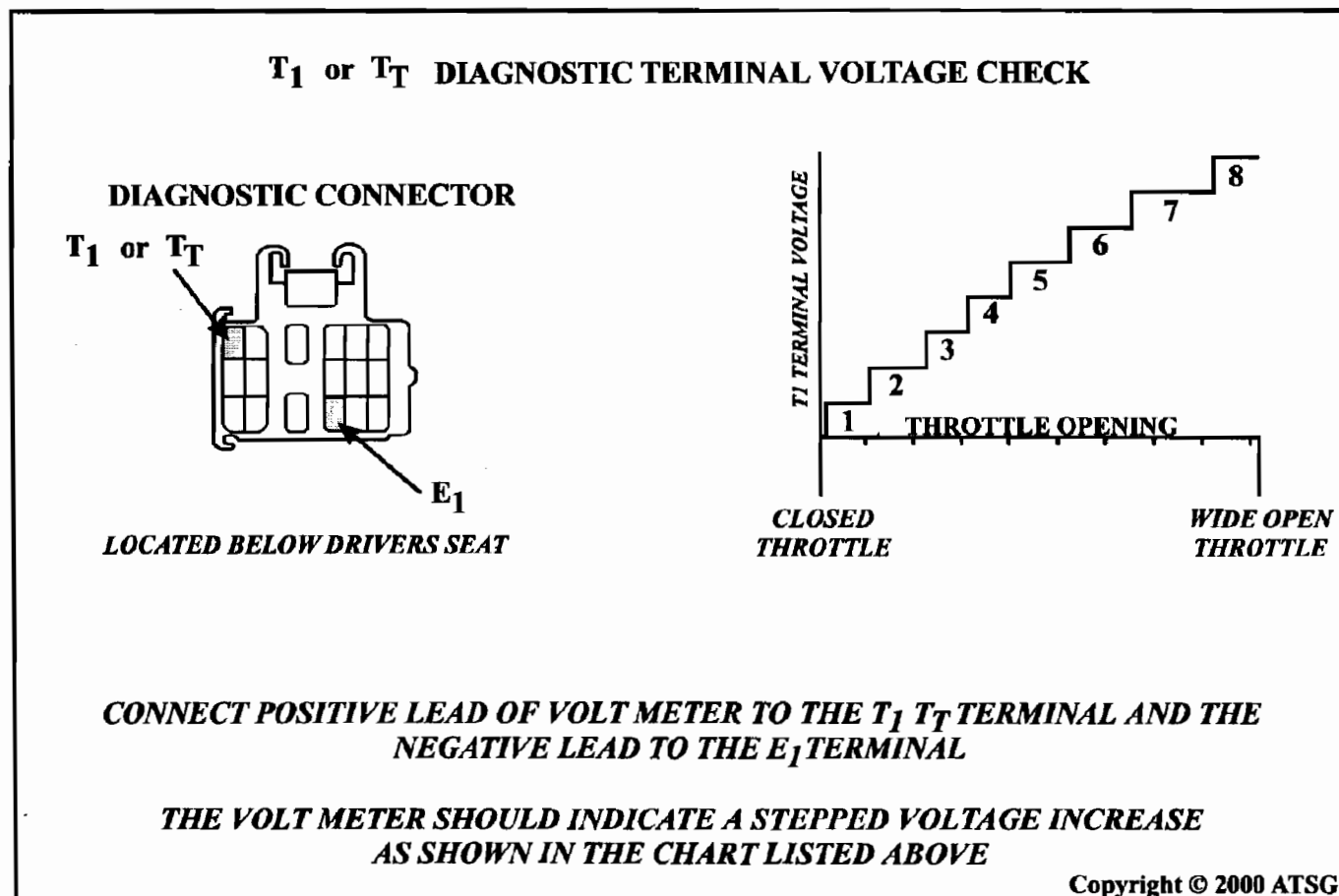
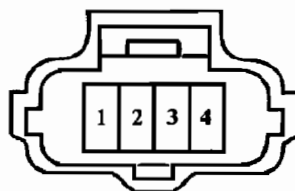
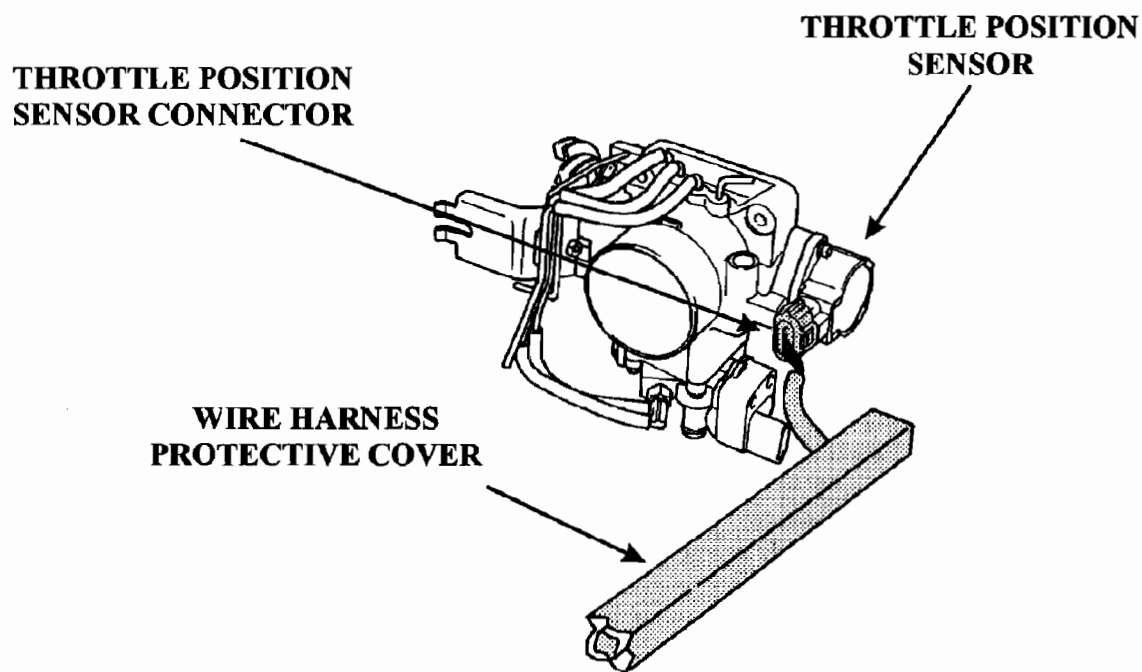


Figure 1

THROTTLE POSITION HARNESS CONNECTOR FACE VIEW



TERMINAL	WIRE COLOR	FUNCTION
1	BROWN/BLACK	E2-(GROUND)
2	BLUE/YELLOW	IDL-(IDLE SWITCH)
3	YELLOW/RED	VTA-(SIGNAL RETURN)
4	BLUE/BLACK	VC-(5 VOLTS IN)



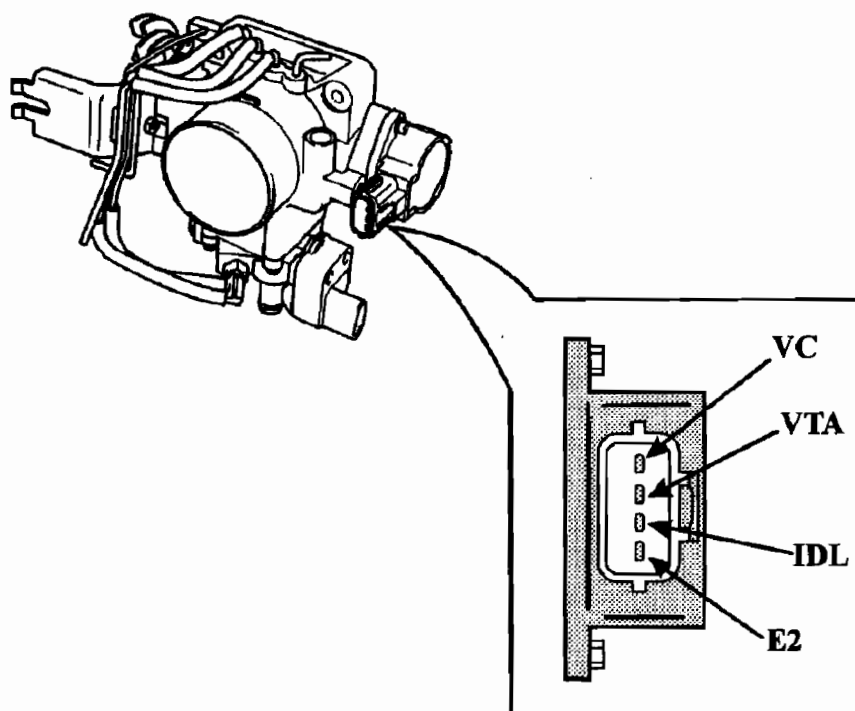
WIRES NORMALLY BREAK AT THE CONNECTOR OR WHERE THE WIRES ENTER THE PROTECTIVE COVER

A TPS CONNECTOR FROM A 1.8L TERCEL FROM A SALVAGE YARD WILL WORK AS A REPAIR KIT TO SAVE THE WIRE HARNESS

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Figure 2

THROTTLE POSITION SENSOR OHM CHECK



CONNECT OHM METER TO TERMINALS	THROTTLE OPENING	OHM VALUE (k Ω)
IDL-E2	FULLY CLOSED	LESS THAN 2.3 Ω
	OPEN	INFINITY
VTA-E2	FULLY CLOSED	0.2-0.8
	FULLY OPEN	3.3-10

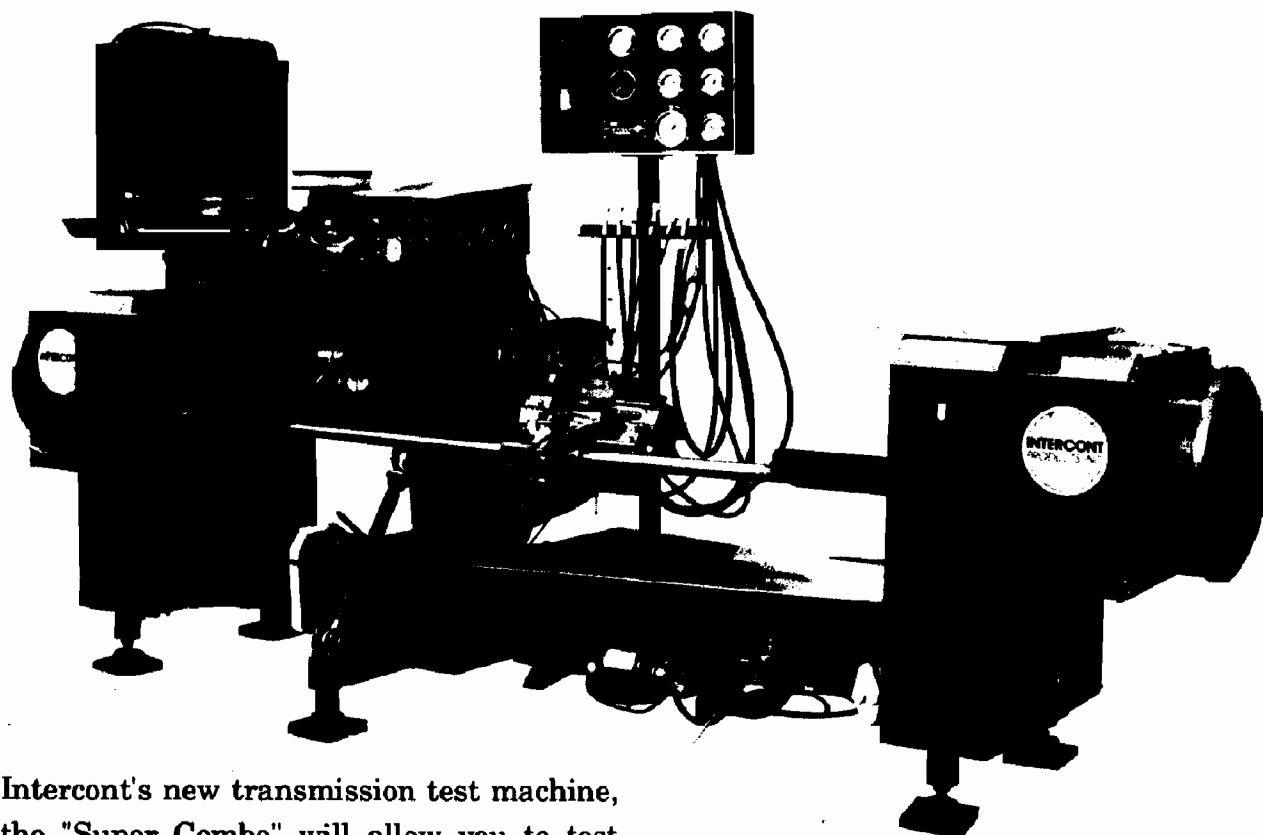
CONNECT AN OHM METER TO THE TERMINALS LISTED ABOVE AND ENSURE THE VALUES ARE WITHIN THE SPECS LISTED ABOVE

WHEN CHECKING VTA-E2 ENSURE THE OHM VALUE CHANGE FROM CLOSED THROTTLE TO FULLY OPEN IS SMOOTH

Figure 3

TEST YOURSELF

with Intercont's new Super Combination Transmission Test Machine



Intercont's new transmission test machine, the "Super Combo" will allow you to test virtually every transmission known. With an exclusive 1:1 gear ratio from a gas powered engine, the "Super Combo" is designed to test right hand rotations, rear wheel drive, and even the left hand rotation Honda transmission.

Hand-built by skilled professionals, the "Super Combo", as well as all of Intercont's quality products, is built to withstand day-to-day use for years. At Intercont, we know the problems associated with testing transmission effectively, so we build the solutions.

Call your Intercont sales representative at 1-800-749-3939 for more details about the "Super Combo" or other quality testing and washing equipment.

TOYOTA 240 SERIES TRANSAXLE

NO MOVEMENT

COMPLAINT: The vehicle exhibits a "no move" condition. When the transmission is disassembled, nothing obvious is found that would cause the "no move" condition. It is assumed that the converter is at fault. *When the rebuilt transmission and converter is installed back into the vehicle, the same "no move" condition exists.*

CAUSE: The component that was overlooked that caused the "no move" condition is the counter shaft/ring gear assembly shown in figure 1. The actual cause of the "no move" condition is the stripped teeth of the counter shaft ring gear flange. With these teeth stripped, the mechanical connection between the counter shaft and the final drive is lost, resulting in the "no move" condition. (Refer to Figure 2)

NOTE: *Do not mistake the intermediate shaft and ring gear assembly for the counter shaft assembly, they look similar. The counter shaft assembly engages the underdrive clutch drum while the intermediate shaft and carrier assembly engage the low/reverse clutch.*

The reason for overlooking this damage is two fold. First, this component is usually not disassembled because the technician may not want to loose the preload on the counter shaft bearings which would save time by not having to set up the counter shaft bearing preload due to the fact that preload is set via a crush collar.

Second, due to the bearing preload, when the counter shaft is rotated, the ring gear turns with it thereby fooling the technician into thinking there is nothing wrong with this assembly.

CORRECTION: If a vehicle equipped with a 240 series transaxle is towed in with a "no move" condition, be sure the counter shaft/ring gear assembly is disassembled and inspected.

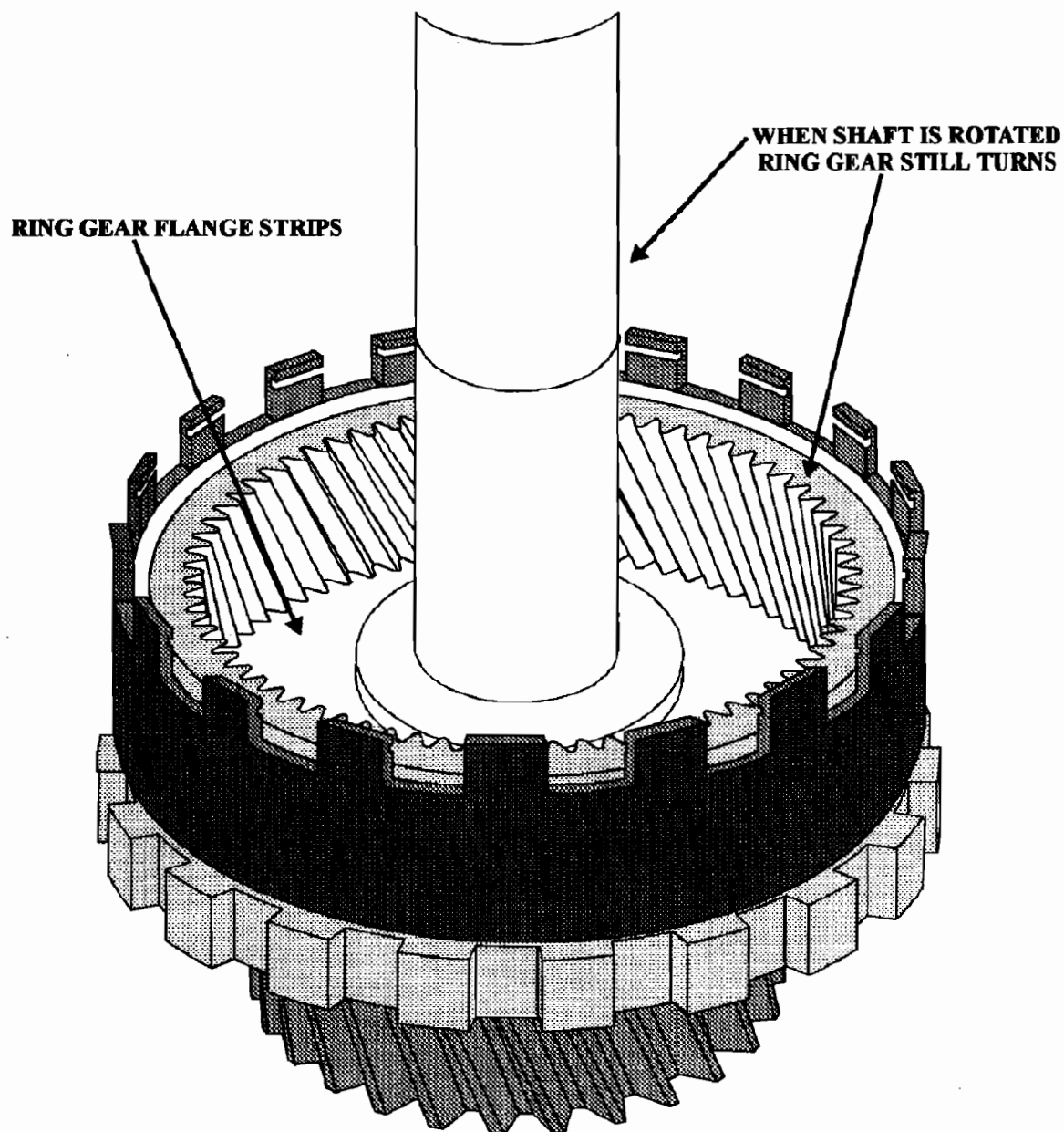
Use the following procedure to reestablish the counter shaft bearing preload:

- (1) Assemble items 1 through 11, as shown in figure 2, using a new crush collar.
- (2) Torque lock nut to 130 Ft. Lbs.
- (3) Using an inch pound torque wrench attached to the lock nut, measure the preload drag which should be **5.2 - 8.7 in. lbs. with new bearings**, or **2.6 - 4.3 in. lbs. with reused bearings**.
- (4) If this preload drag has not been reached, tighten the lock nut in **SMALL** increments, rotating the shaft 360° at least twice, each time the lock nut is tightened, until the correct preload is reached.
- (5) Stake the lock nut in place.

TOYOTA 240 SERIES TRANSAXLE

NO MOVEMENT

COUNTER SHAFT COMPONENTS



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Figure 1

TOYOTA 240 SERIES TRANSAXLE

NO MOVEMENT

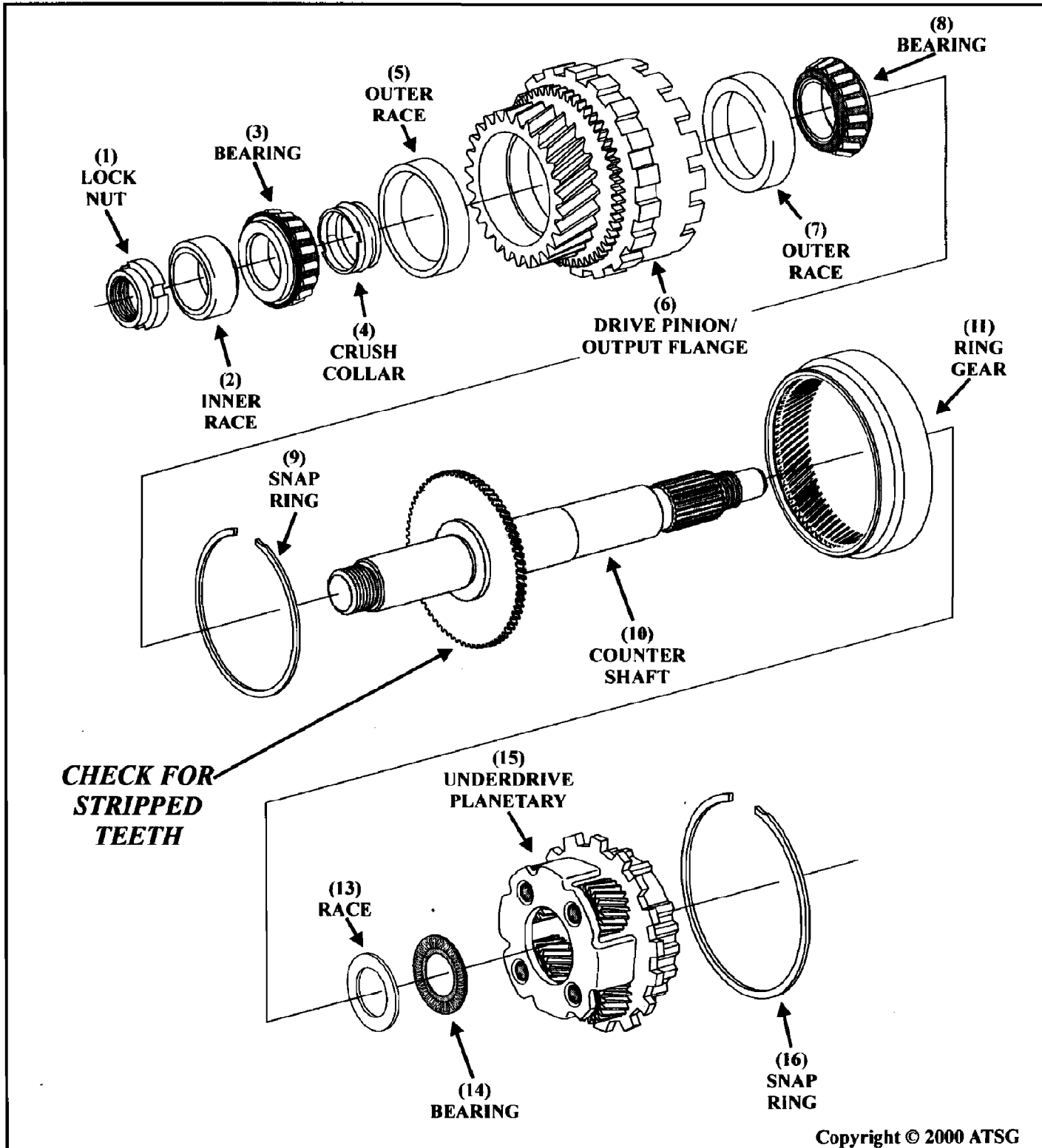
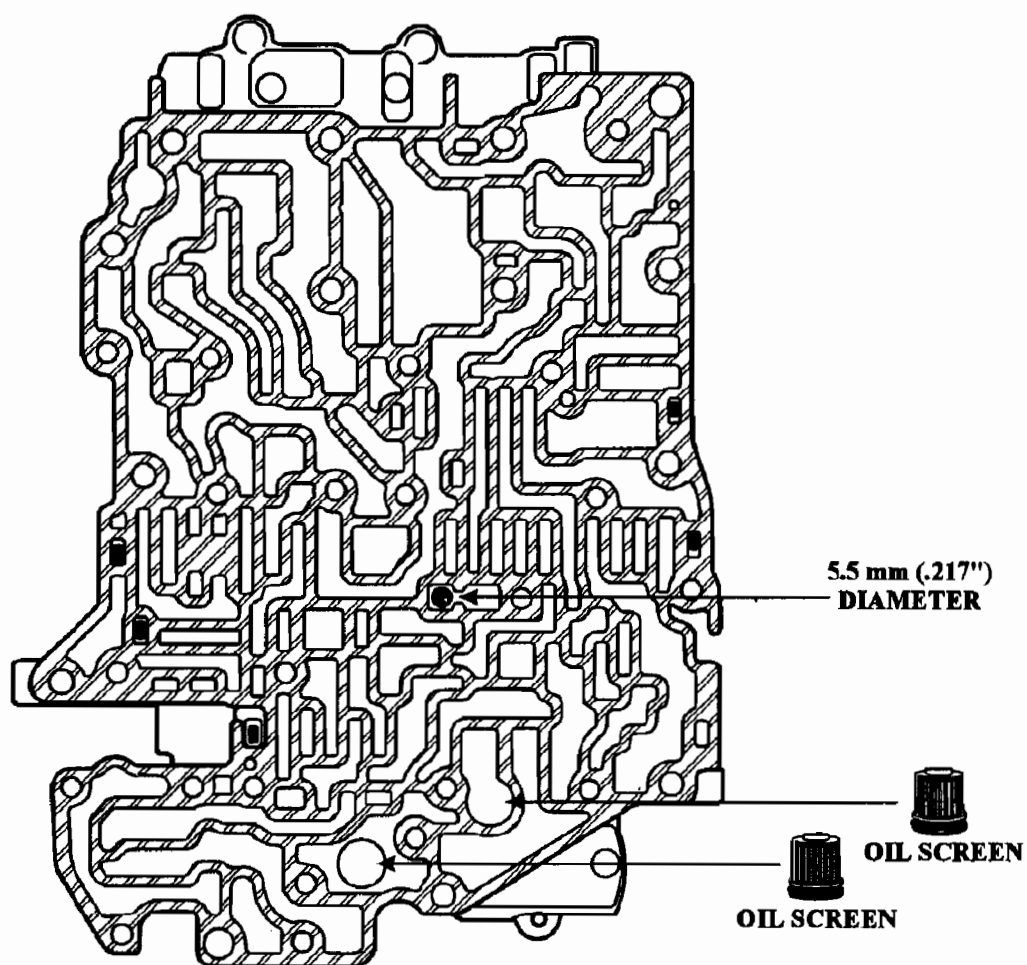
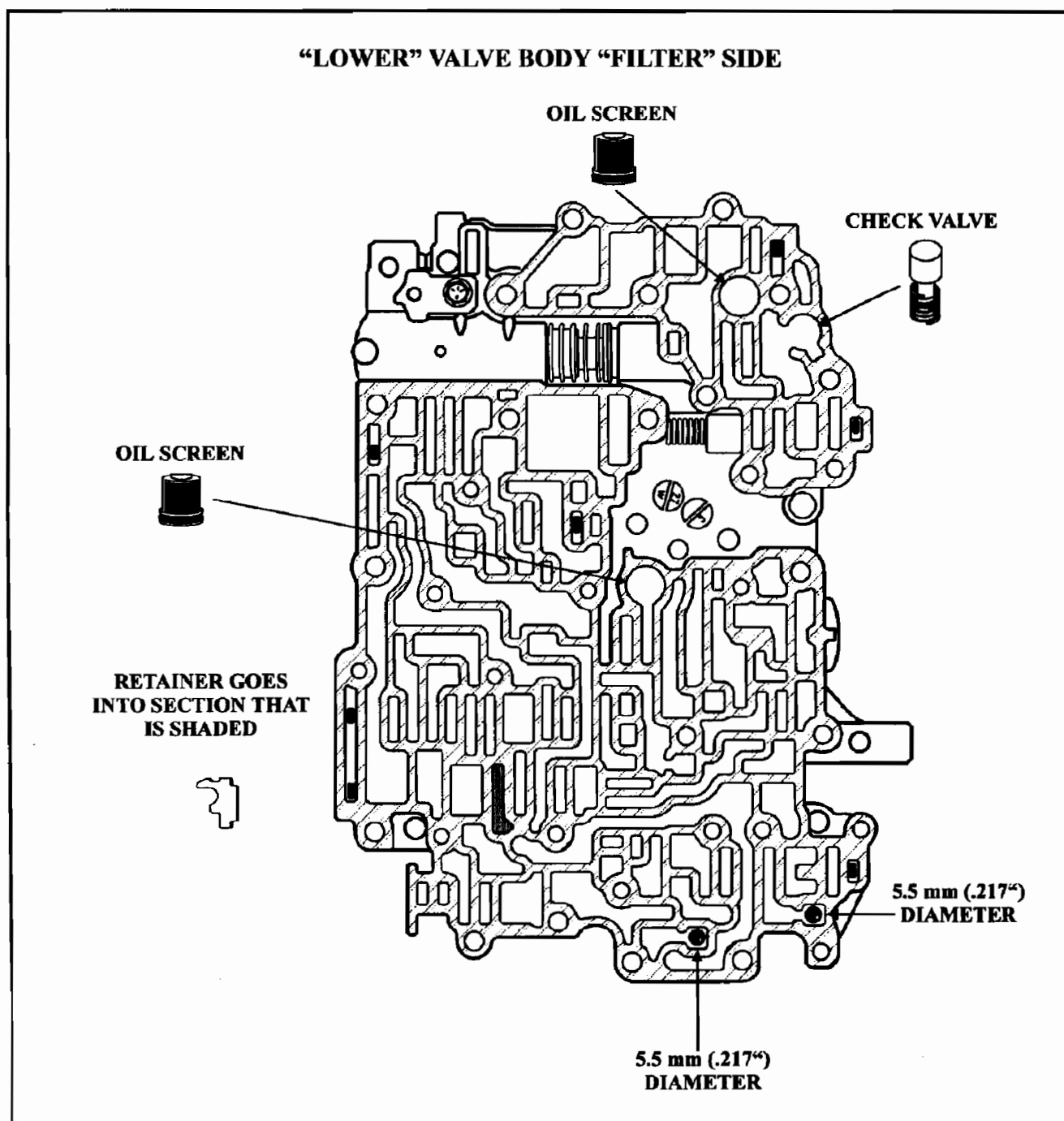


Figure 2

TOYOTA/LEXUS A541E
CHECKBALL AND RETAINER LOCATIONS**"LOWER" VALVE BODY "CASE" SIDE**

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Figure 1



"UPPER" VALVE BODY AND ACCUMULATOR HOUSING

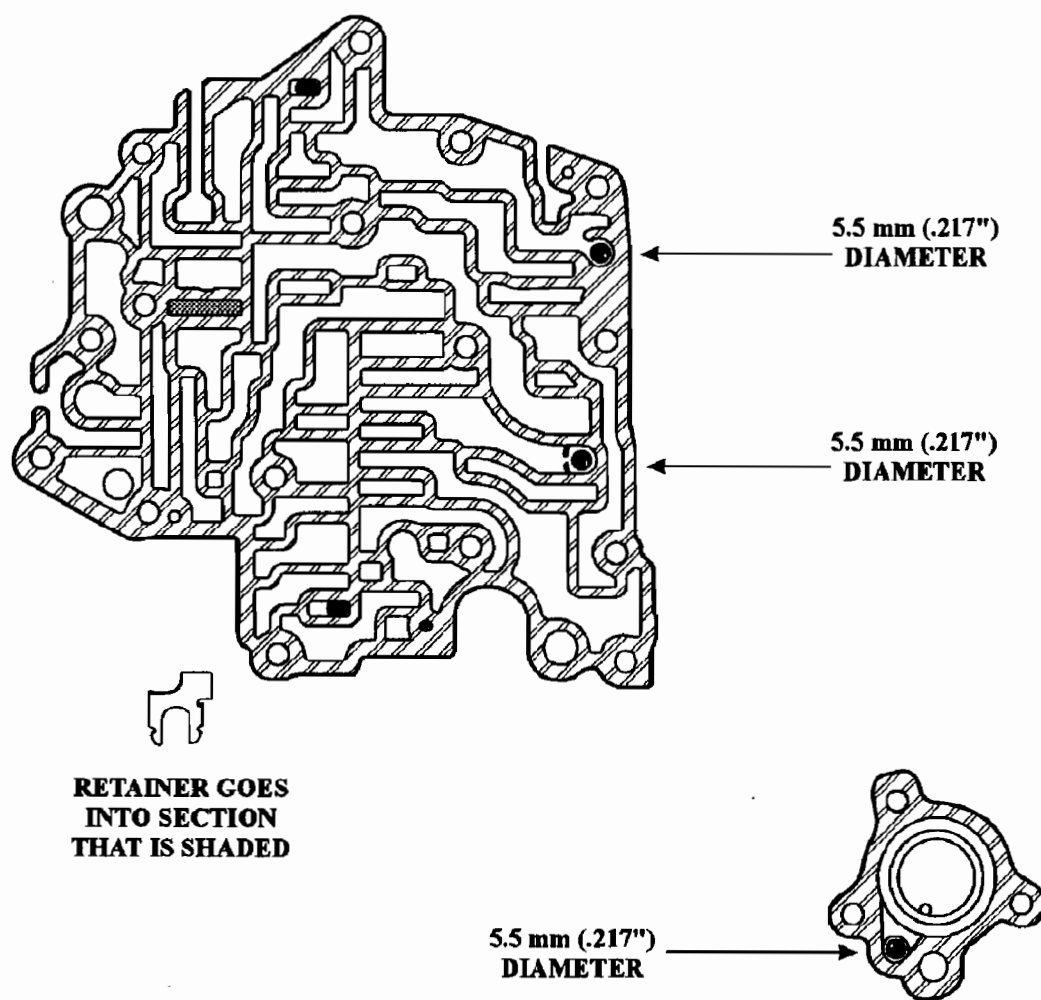
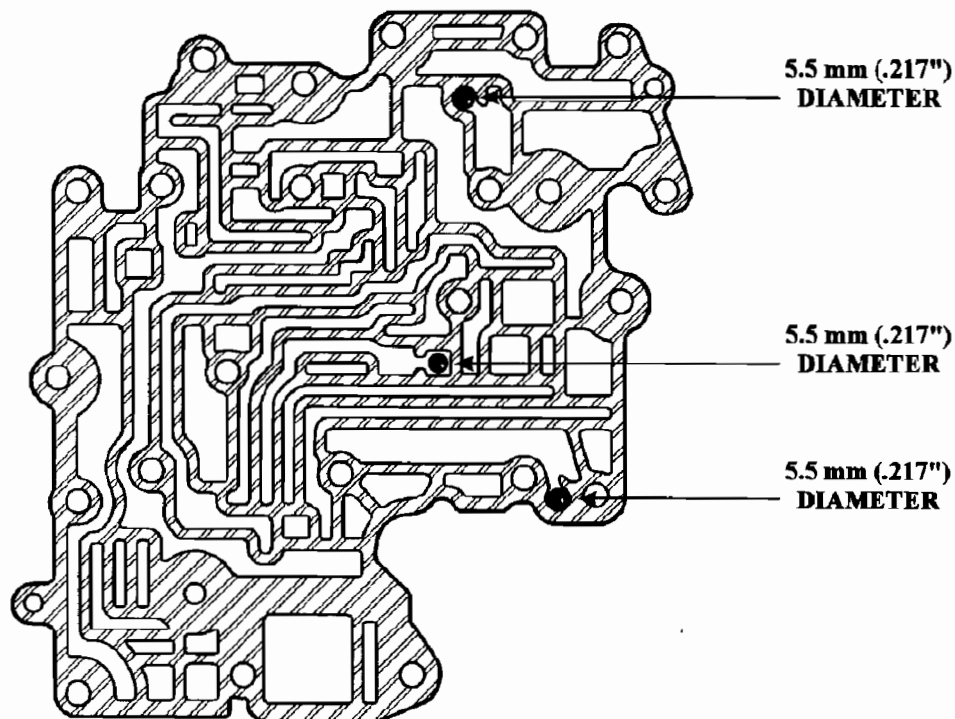


Figure 3

"LOWER" VALVE BODY COVER



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Figure 4

LEXUS A341E

HARSH 3RD AND REVERSE

COMPLAINT: After overhaul, some 1991-1992 model Lexus equipped with A341E transmissions, may exhibit a harsh upshift into 3rd gear and a hard application into Reverse.

CAUSE: The cause may be, a check ball was added to the Upper Valve Body for the 93 and up checkball locations as shown in Figure 2. When this happens, the C2 or Direct clutch can apply at a faster rate, because the passage to the C2 or Direct accumulator piston is restricted by the ball.

CORRECTION: Refer to Figure 1 for the correct checkball location for 1991-92 model applications and Figure 2 for 1993 and later models.

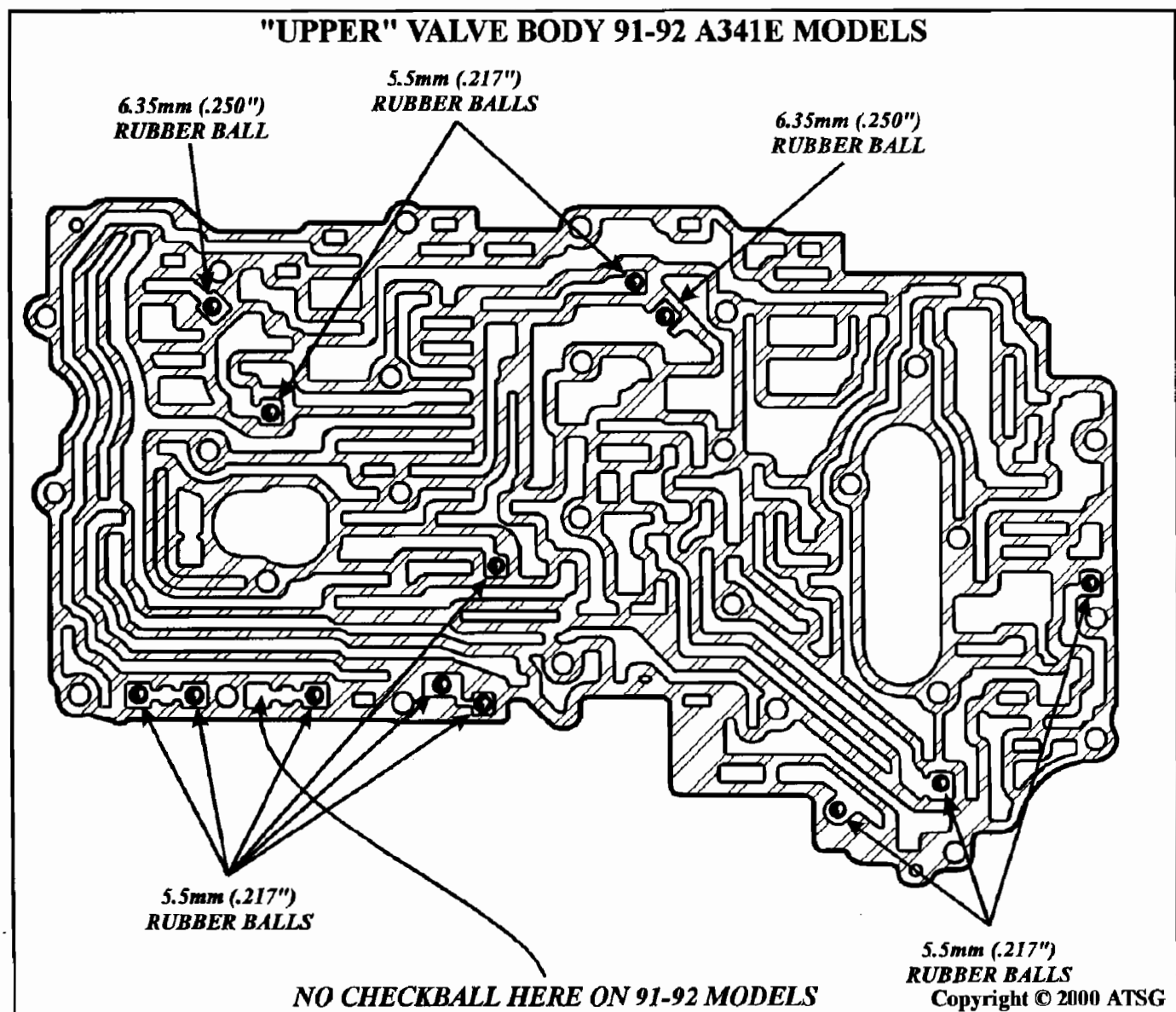
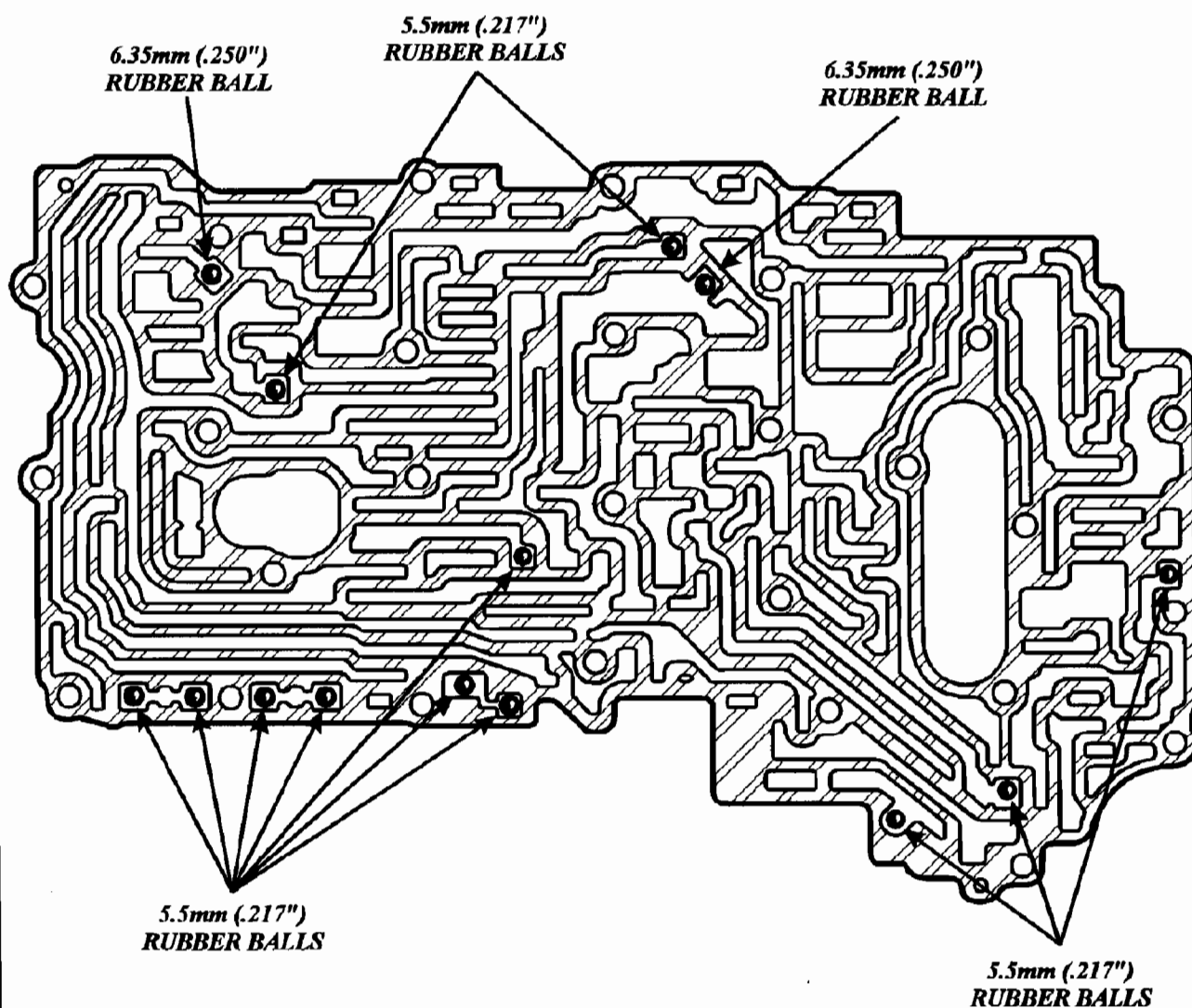


Figure 1

"UPPER" VALVE BODY 93 AND LATER "ONLY" A341E MODELS



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Figure 2



VOLVO AW50-42LE
HARSH REVERSE ENGAGEMENT

COMPLAINT: Harsh engagement into reverse, forward engagement is normal. Line pressure is also normal.

CAUSE: There can be four (4) possible causes:

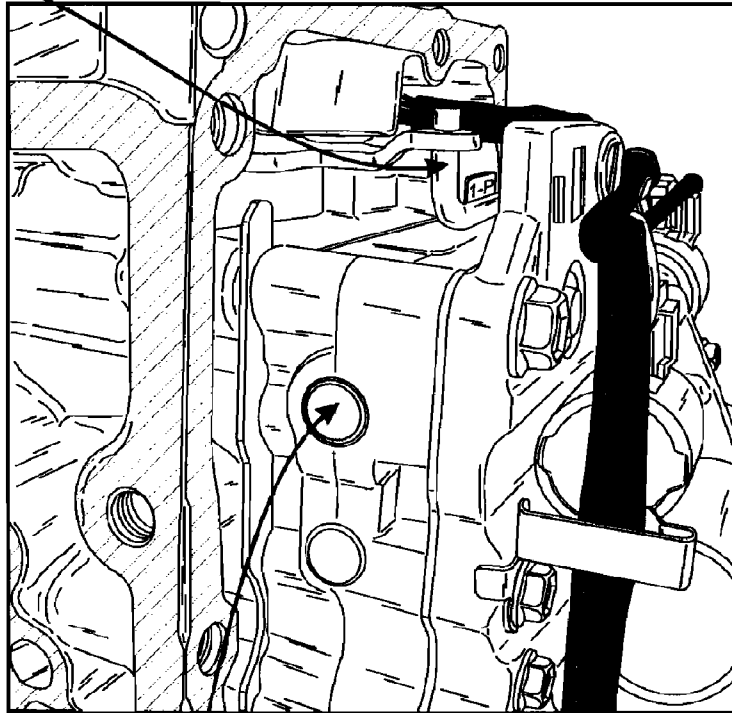
- (1) Misadjustment of the manual valve due to a linkage problem or the manual valve link that connects the internal linkage to the manual valve as seen in figure 1.
- (2) The installation of flat friction plates instead of the OE style **WAVED** friction plates in the C2 (DIRECT) clutch pack as shown in figure 2.
- (3) Wearing of the center ring land in the C1 (FORWARD)/C2 (DIRECT) drum in the rear cover as illustrated in figure 3.

CAUTION: Early units use an **ALUMINUM** support in the rear cover, which must use **METAL** rings. Late units use a **STEEL** support which use **TEFLON®** rings. The use of Teflon® rings in an early cover with the **ALUMINUM** support will **DESTROY** the support.

- (4) A worn upper torque arm which cushions engine movement when selecting reverse (Refer to Figure 4).

CORRECTION: Make the corrections as follows:

- (1) With the shift lever in the "Park" position, the end of the manual valve should be **FLUSH** with the valve body casting as shown in figure 1 and replace worn parts as necessary.
- (2) Make certain when replacing the C2 (DIRECT) friction plates, that they are **WAVED** as seen in figure 2.
- (3) Be sure to check the center ring land for wear (Refer to Figure 3) and to replace the rear cover if the ring land wear is excessive, preferably using a rear cover with the **STEEL** support. Also be sure to use the correct rings for the type of material the support is made with as follows:
Aluminum Support.....Metal Rings
Steel Support.....Teflon® Rings
- (4) Check the condition of the upper torque arm as seen in figure 4 and replace as needed.

VOLVO AW50-42LE
HARSH REVERSE ENGAGEMENT**MANUAL VALVE
LINK**

**THE END OF THE MANUAL VALVE IS
FLUSH WITH THE END OF THE VALVE
BODY CASTING, WHEN THE SELECTOR
IS IN THE "PARK POSITION"**

Figure 1

VOLVO AW50-42LE

HARSH REVERSE ENGAGEMENT

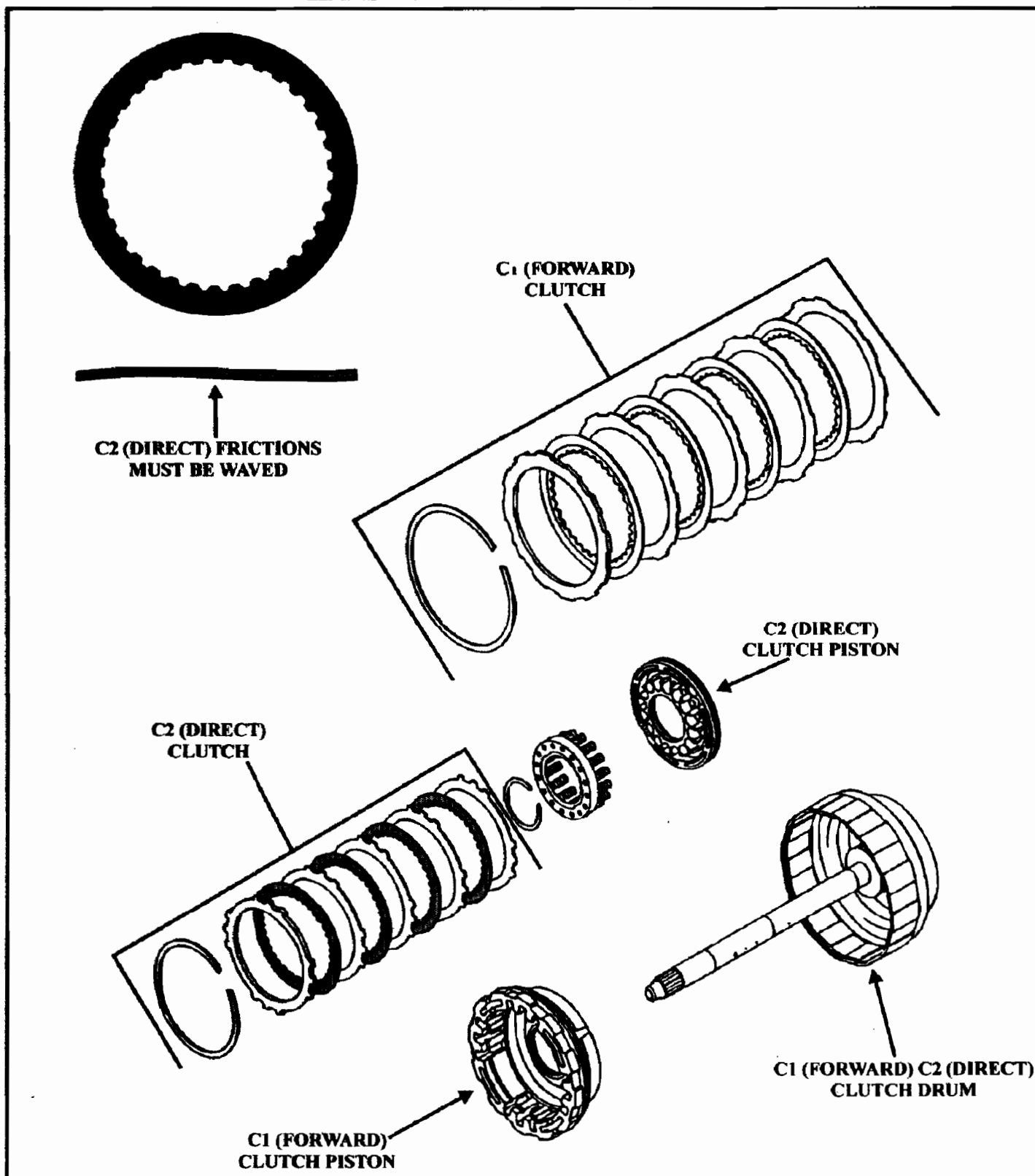
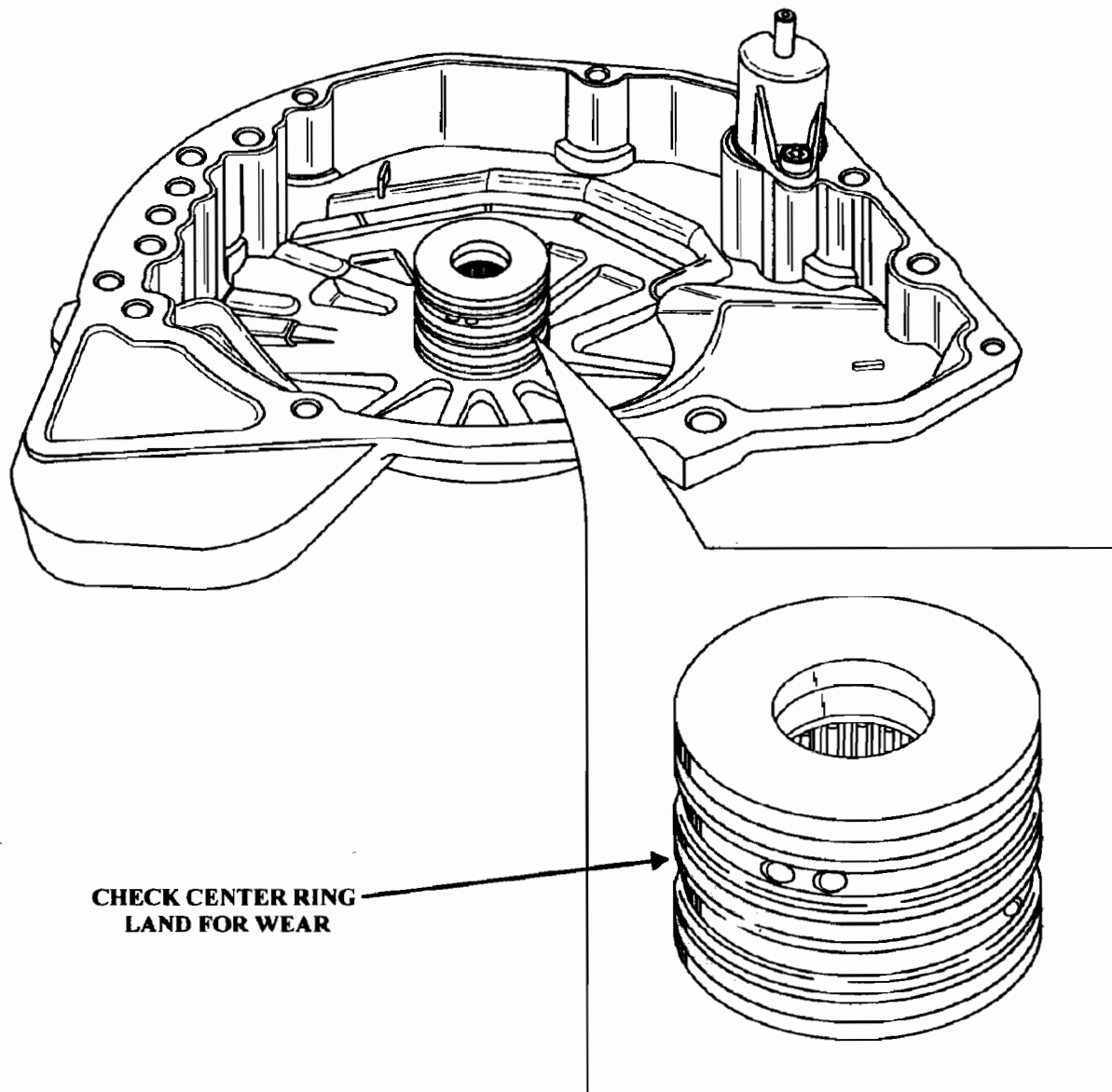


Figure 2

VOLVO AW50-42LE**HARSH REVERSE ENGAGEMENT****REAR COVER AND C1/C2 DRUM SUPPORT**

ALUMINUM SUPPORT MUST USE METAL RINGS
STEEL SUPPORT USES TEFLON® RINGS

Figure 3

VOLVO AW50-42LE
HARSH REVERSE ENGAGEMENT

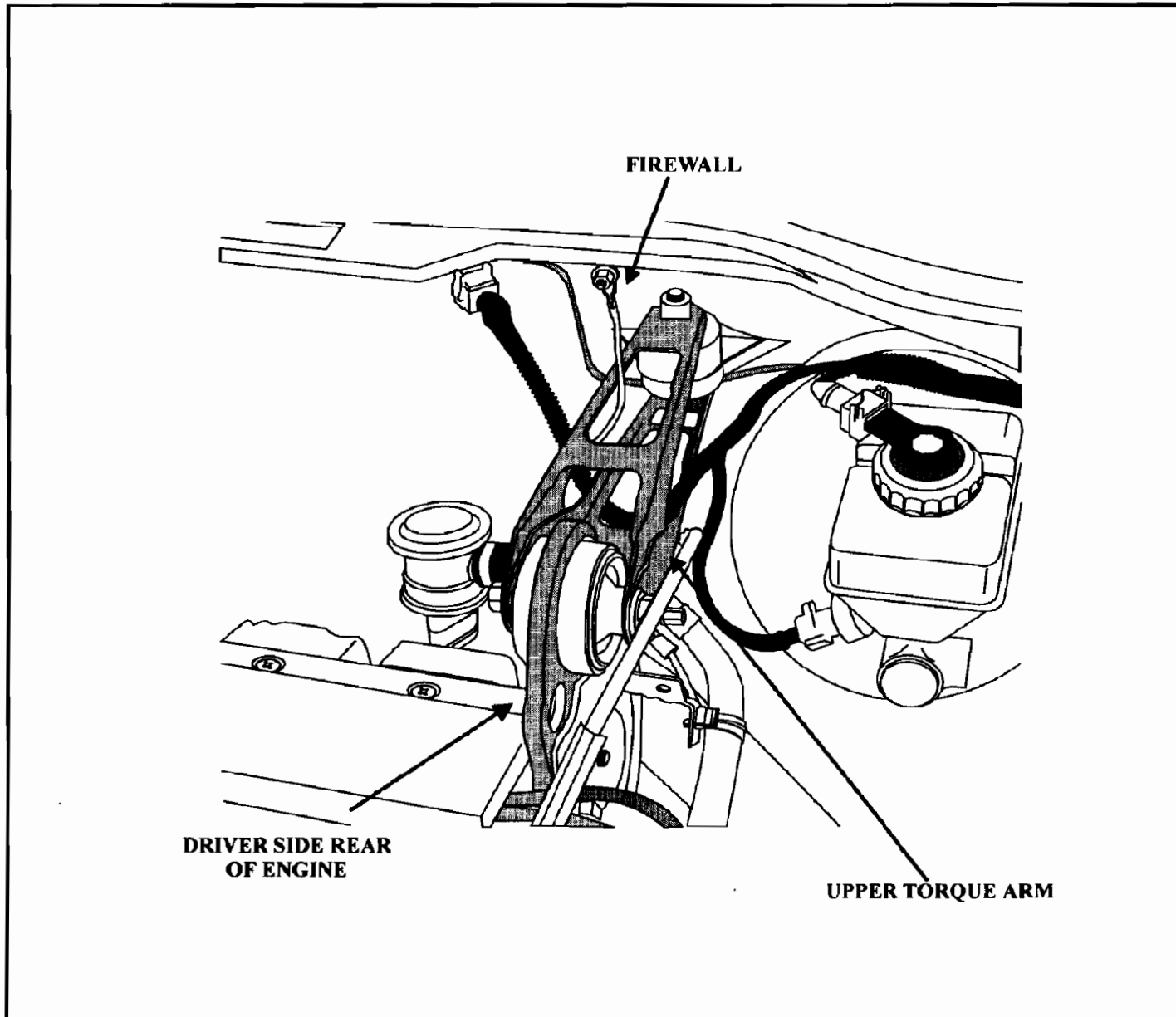


Figure 4

VOLVO 50-40LE/50-42LE

NO REVERSE, 1ST OR 4TH GEAR

COMPLAINT: Vehicles equipped with the 50-40LE or the 50-42LE transaxle may exhibit a No Reverse No 1st and No 4th condition before and/or after overhaul.

CAUSE: The cause may be,

1. While cleaning and servicing the valve body, the solenoid screens were installed upside down blocking solenoid feed to the shift solenoids and shift valves as shown in Figure 2.
2. The Shift solenoids are not functioning mechanically.

CORRECTION: Follow the corrections listed below:

1. Assemble the solenoid screens as shown in Figure 3.
2. Check the Shift Solenoids mechanically as shown in Figure 4 and replace as necessary.

SERVICE INFORMATION:

SOLENOID 1 & 2 (*Volvo Part Number*).....6843783

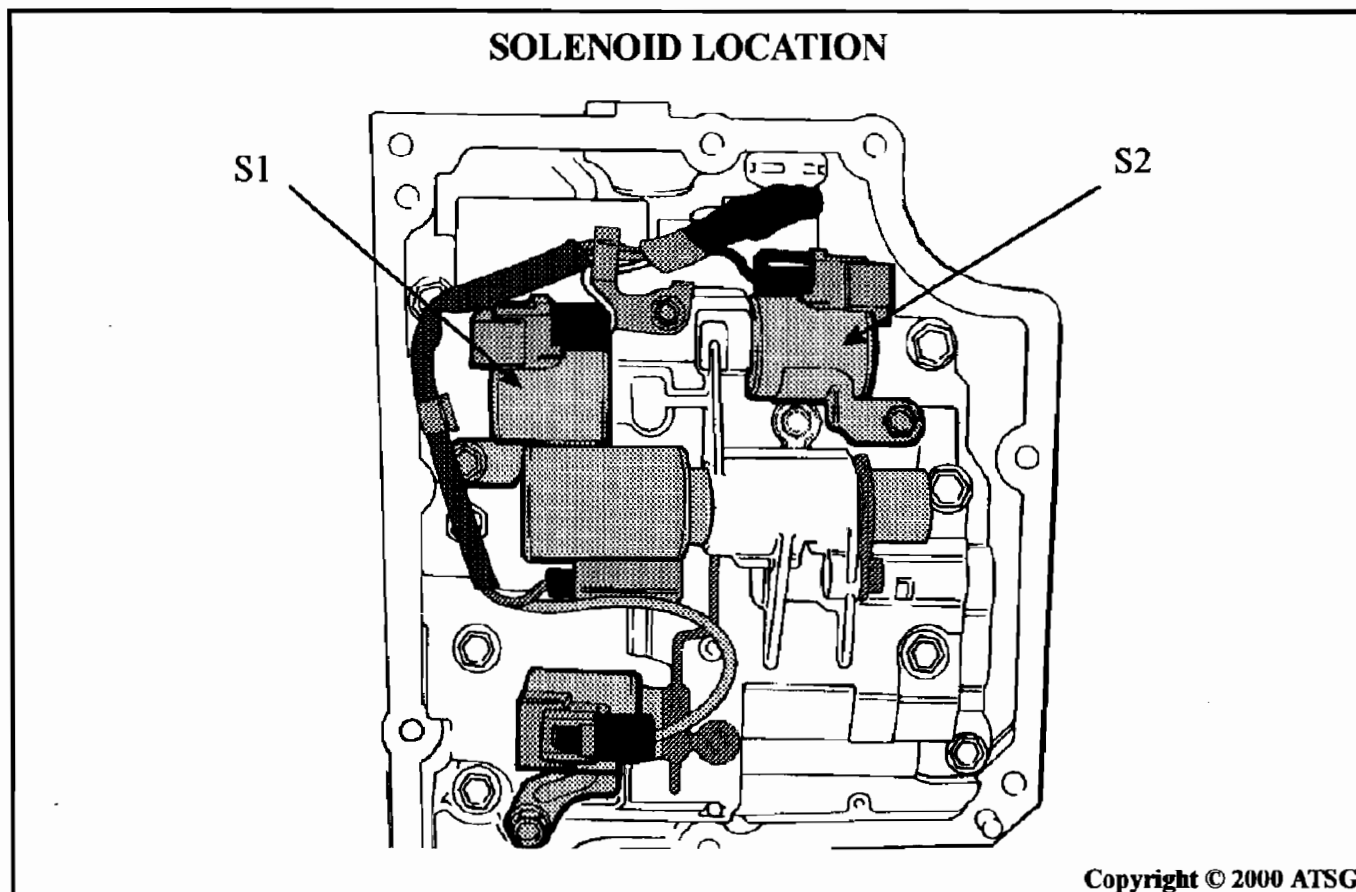
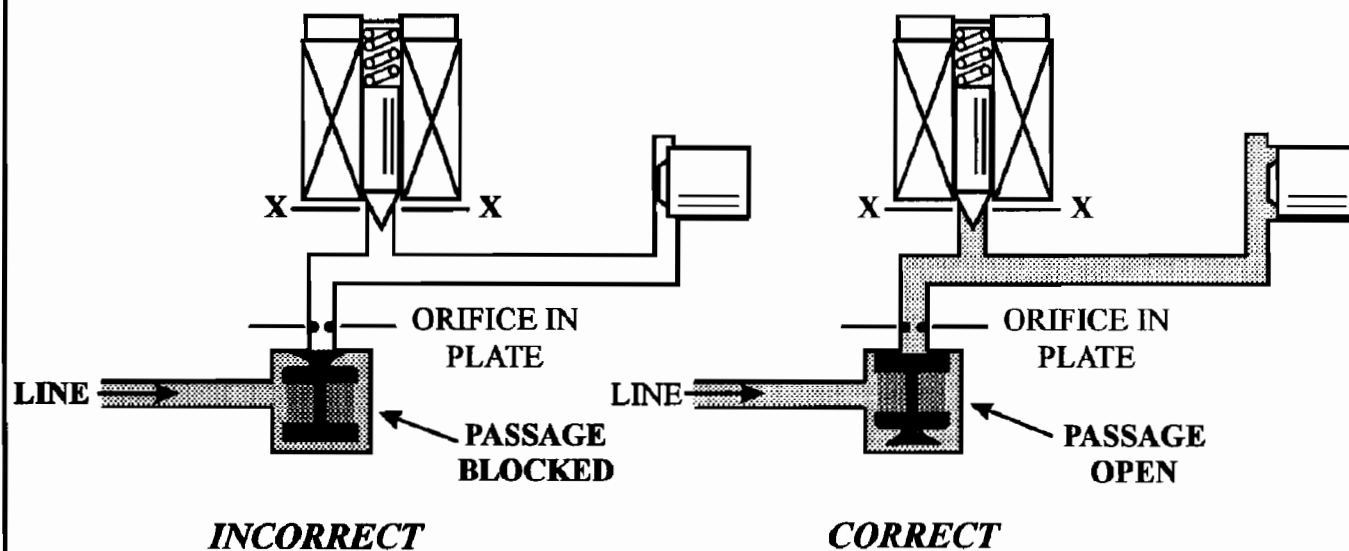
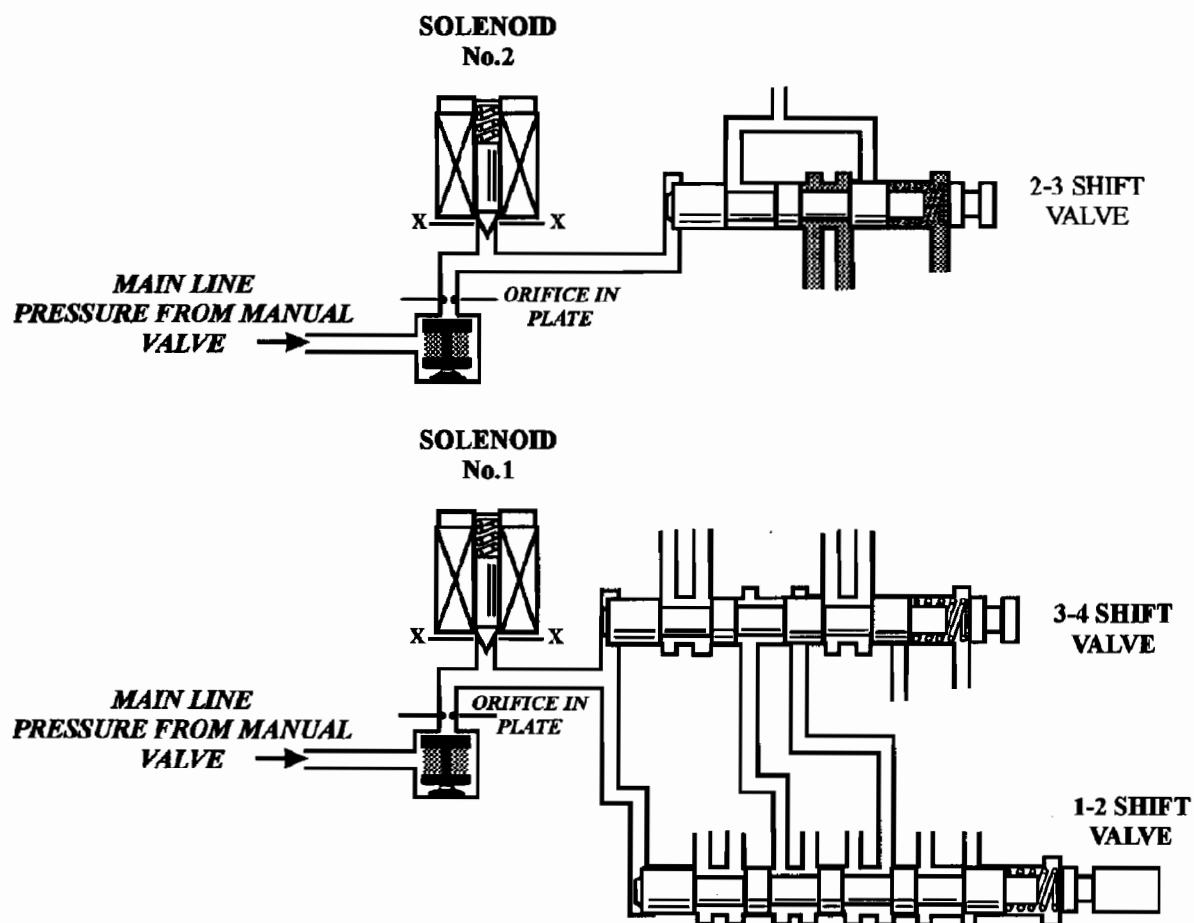


Figure 1

SOLENOID SCREENS



SOLENOID 1 AND 2 PARTIAL HYDRAULIC SCHEMATICS

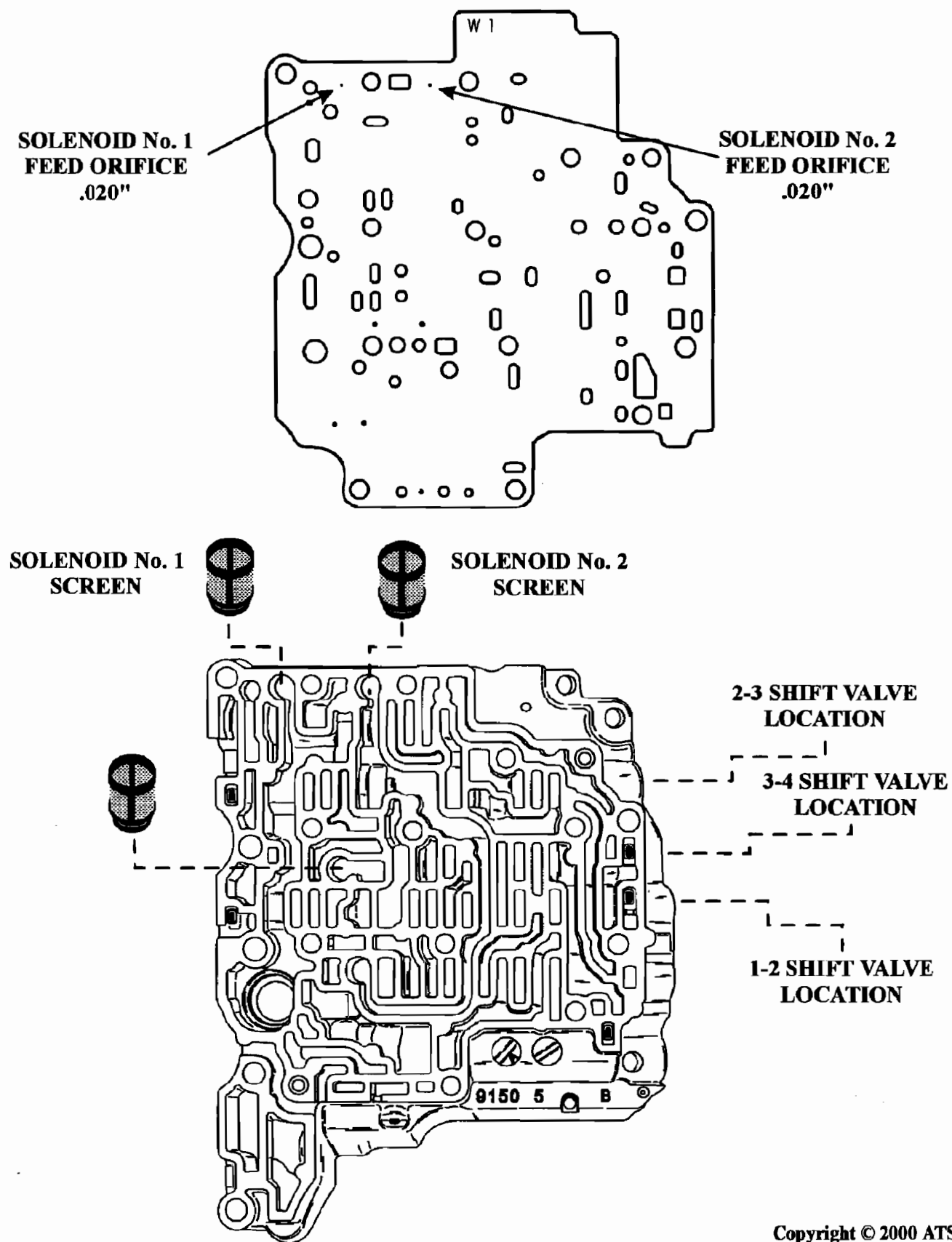


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Figure 2

Automatic Transmission Service Group

CENTER VALVE BODY AND SPACER PLATE

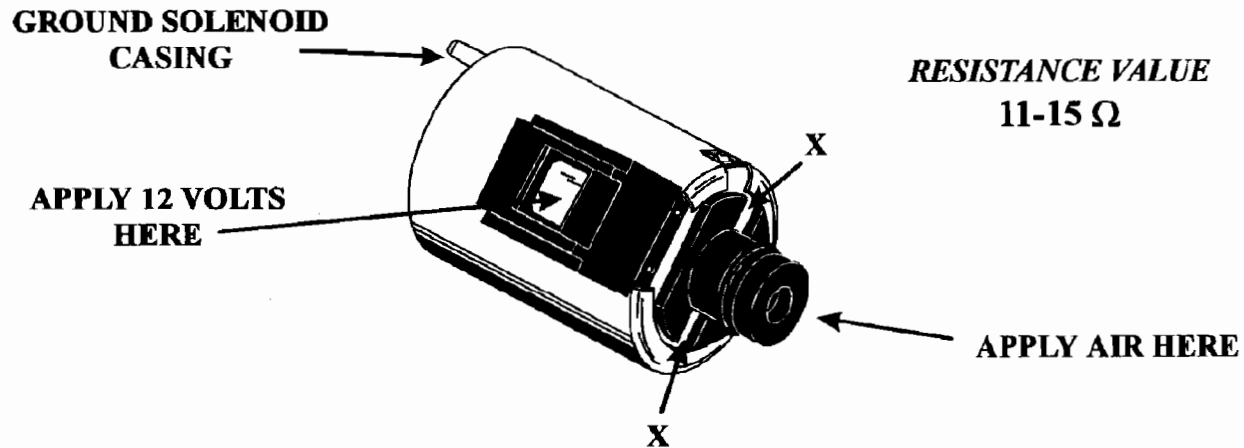


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Figure 3

SOLENOID 1 AND 2 FUNCTIONAL CHECK

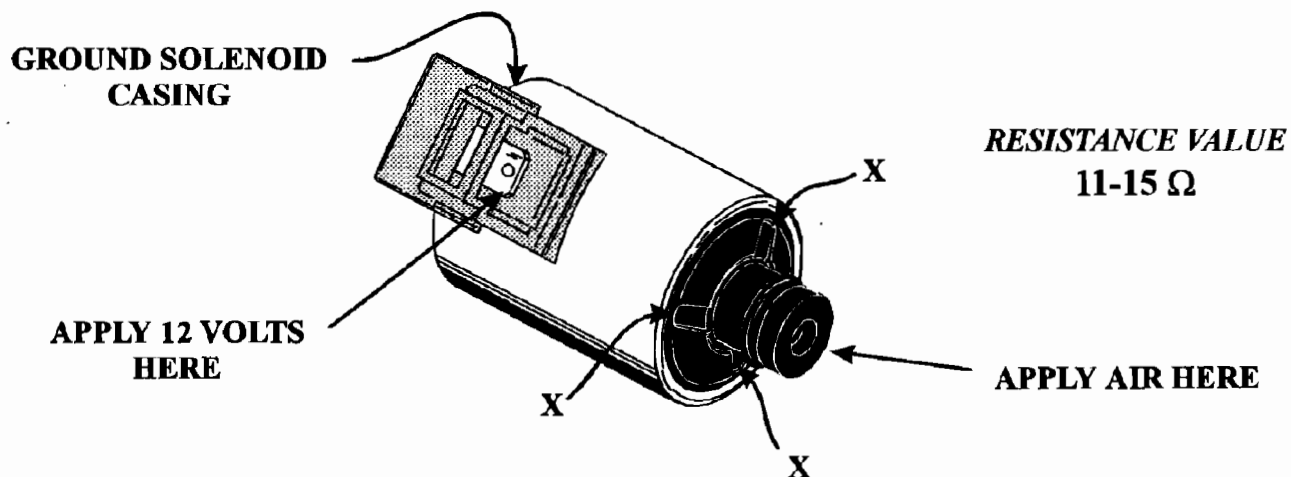
EARLY VERSION S1 "BLACK CONNECTOR"



SOLENOID 1 IS NORMALLY CLOSED
APPLY 40-60 psi. OF AIR PRESSURE TO THE SNOUT OF SOLENOID
AIR PRESSURE MUST NOT LEAK OUT OF EXHAUST PORTS UNTIL
THE SOLENOID IS ENERGIZED

NOTE: THE EARLY VERSION SOLENOID 1 IS NOW REPLACED BY SOLENOID 2

LATE VERSION S1&S2 "GREEN CONNECTOR"



SOLENOID 2 IS NORMALLY CLOSED
APPLY 40-60 psi. OF AIR PRESSURE TO THE SNOUT OF SOLENOID
AIR PRESSURE MUST NOT LEAK OUT OF EXHAUST PORTS UNTIL
THE SOLENOID IS ENERGIZED

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Figure 4