*1996 SEMINAR INFORMATION*

# "THE BEST FIX IN '96"

## INDEX

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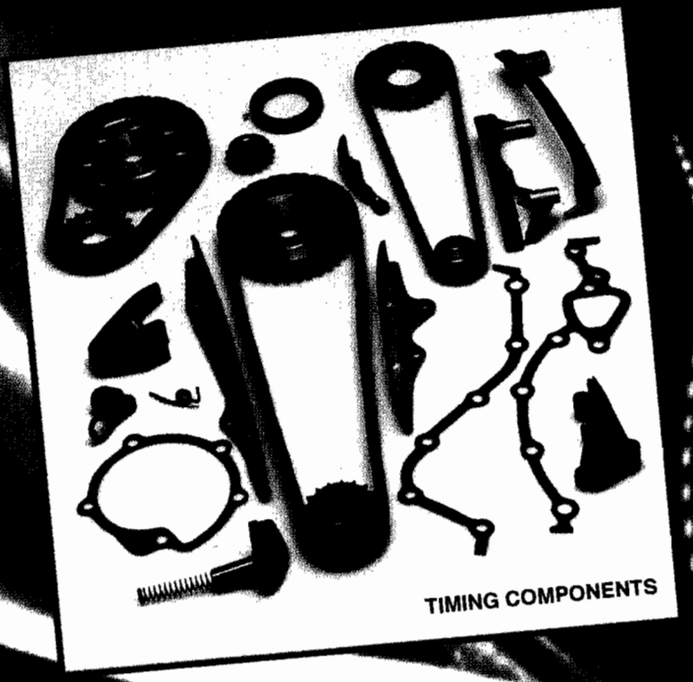

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# "THE BEST FIX IN '96"

## INTRODUCTION

Bob Cherrnay has once again orchestrated ATSG's Tech team into another successful seminar year known as "The Best Fix in '96". Valuable and useful information on the cutting edge presented in both Video and Manuals that you can take back to the shop and use the very next business day. This is a DO NOT MISS seminar. Information will be presented on Imports, G.M., Ford and Chyrsler vehicles. The information will cover up to date factory changes and interchangeability as well as many corrections to problems the shops are faced with TODAY. This years seminar would not be complete without tips on electrical and scanner checks. So Bob has instructed the ATSG Tech team to weave into this years seminar as many electrical and scanner tips one day could allow. So buckle up and enjoy "The Best Fix in '96".



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# KM 175, 176/F4A21, 22
## CONVERTER CLUTCH SHUDDER

Complaint: The converter clutch shudders continuously.

Cause: There is an O ring on the stator shaft that deteriorates causing a loss of converter release pressure. This allows the converter clutch to drag shuddering the engine and causing premature failure of the converter clutch. (See Figure 1).

Correction: It is best to replace the pump cover with a known good one. However, the stator shaft can be pressed out of the cover if care is taken not to distort the cover during the shaft removal process. Replace the O ring and align the holes in the shaft to the cover and carefully press the shaft into place (See Figure 1).

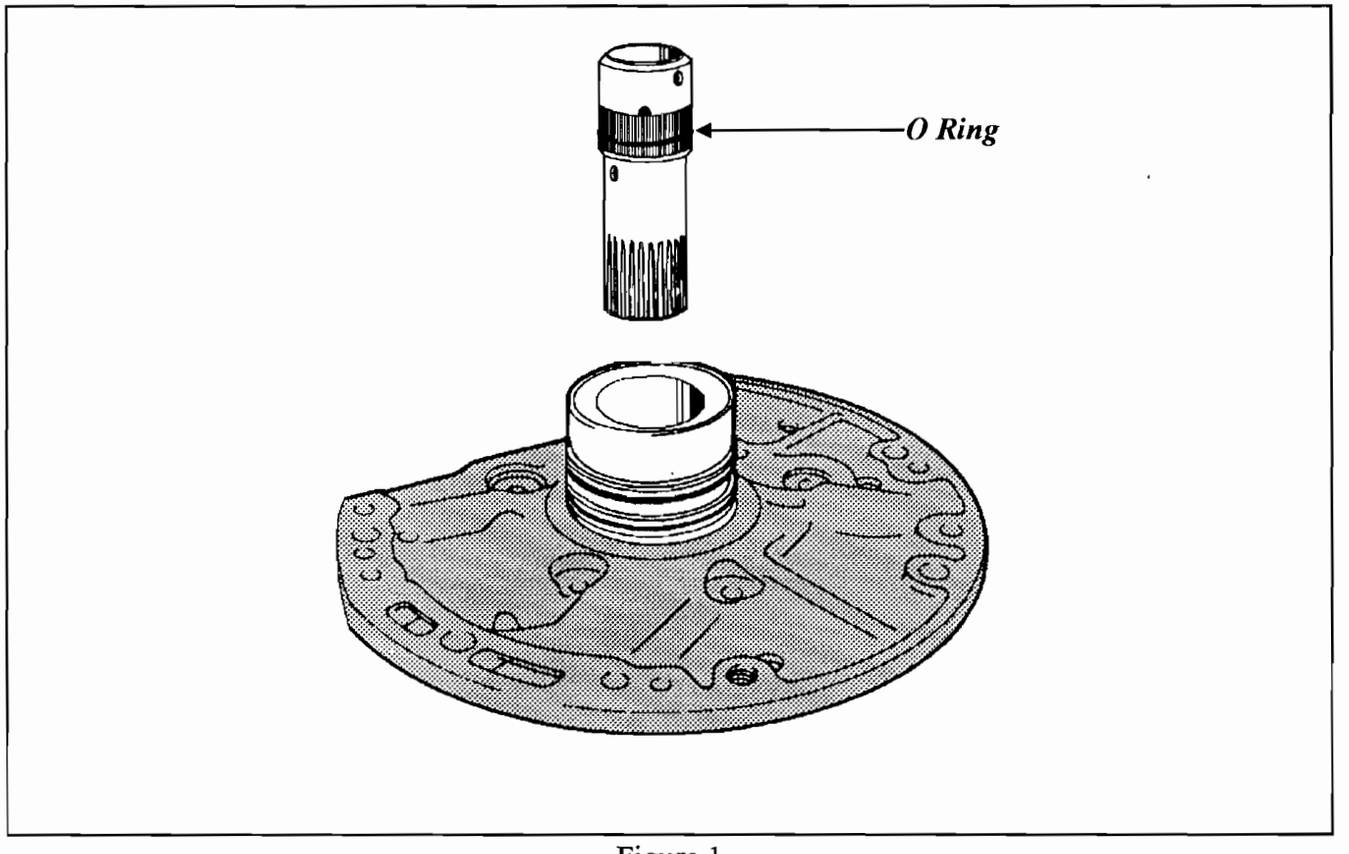



Figure 1

# F4A21, 22, 23 32 & 33
## NO CONVERTER FILL

Complaint: No converter fill after overhaul or filter change.

Cause: A stuck damper clutch control valve. SOME KM's have different length filter bolts and a mispositioned bolt could pinch the valve in its bore.

Correction: Remove the filter. **The valve body does not need to be removed.** Remove the side plate and do a visual check on the damper clutch control valve to see if it is stuck. If it is, free the valve. Once the valve is free, bolt the filter up to the housing with the end plate still removed. Check the valve once again for free movement. Torque lower valve body bolts to 3 to 4 ft. lbs. (See Figure 2) It may also become necessary to drill the torque converter feed orifice in the spacer plate as shown in Figure 3. It is also recommended that the converter be filled before installation and that during the fill of the transmission, the selector is placed in neutral.

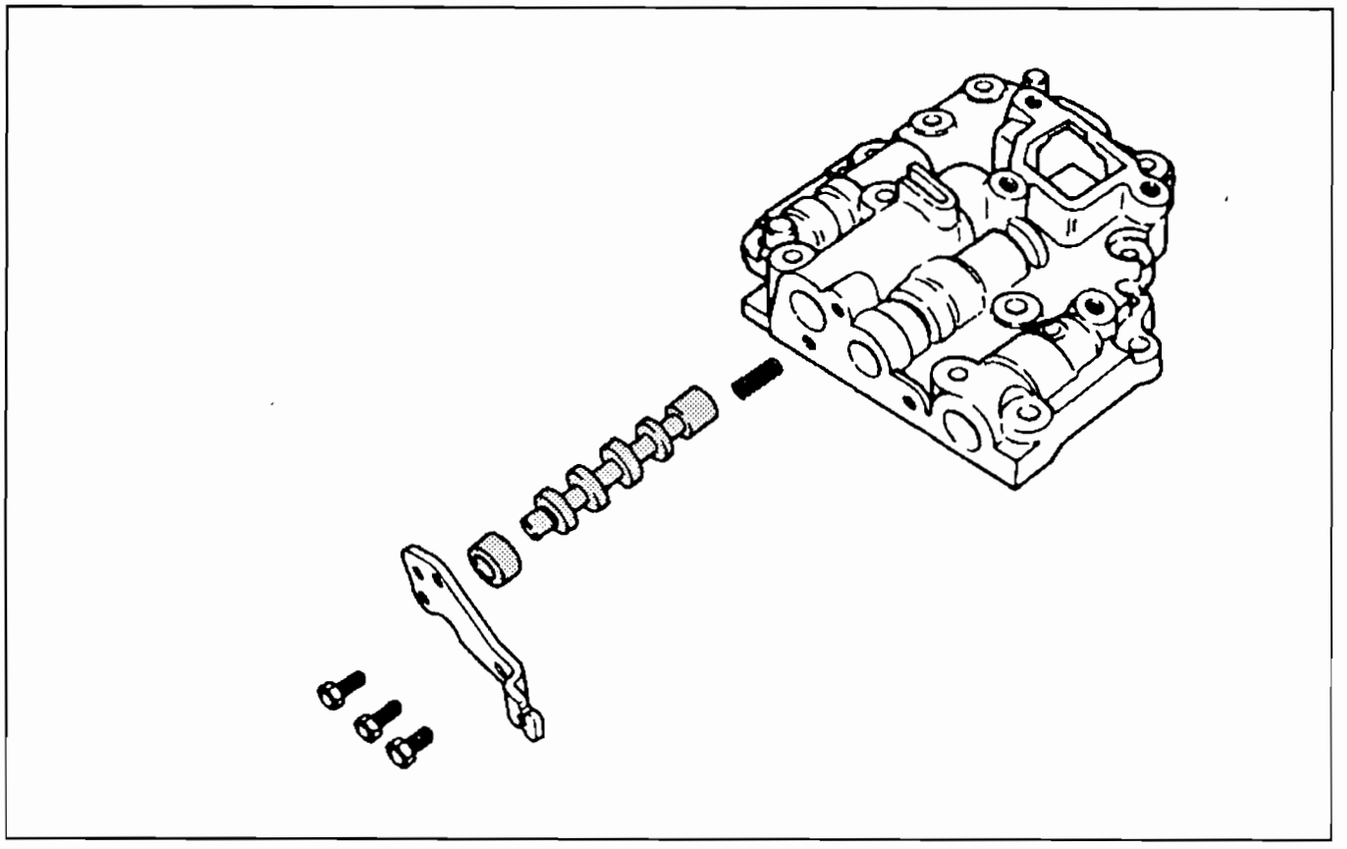


Figure 2

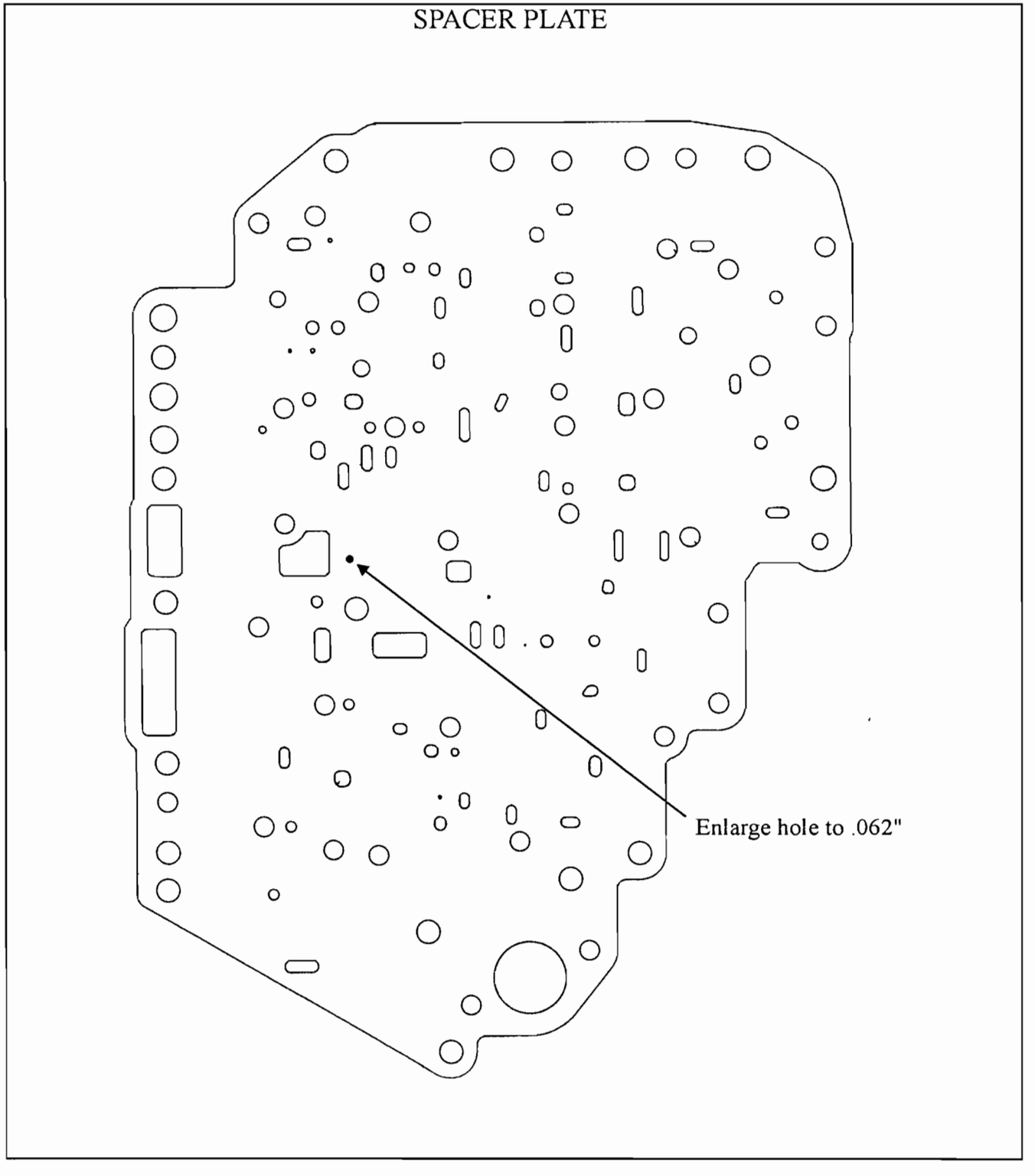



Figure 3

# ALL KM UNITS
## HARSH SHIFT COMPLAINTS

Complaint: Before and/or after overhaul, the transaxle may experience erratic harsh shifts. This may be accompanied with finding a broken servo piston in the servo bore.

Cause: One cause may be due to a broken air exhaust plug which is pressed into the bottom of the servo bore. This air exhaust plug is an aluminum tube which contains a filter. The filter is held into the tube with a flat metal retainer and the tube is known to break at the groove in which this metal retainer sits. This allows both the broken piece of the tube, the metal retainer and filter to fall into the servo bore. These pieces floating around in the servo bore can cause damage to the piston as well as the bore of the case (See Figure 4).

Correction: If the servo bore has been damaged, the case will have to be replaced. If the case is not damaged, the air exhaust plug can be serviced. Care must be taken when removing the old plug. The best method is to drill into the plug and screw into the hole a dent puller tool and pull the plug out. A new plug assembly can be gently tapped back into the case. The part number for Mitsubishi and Hyundai vehicles are listed below:

Mitsubishi - MD733740
Hyundai - 45245-37000

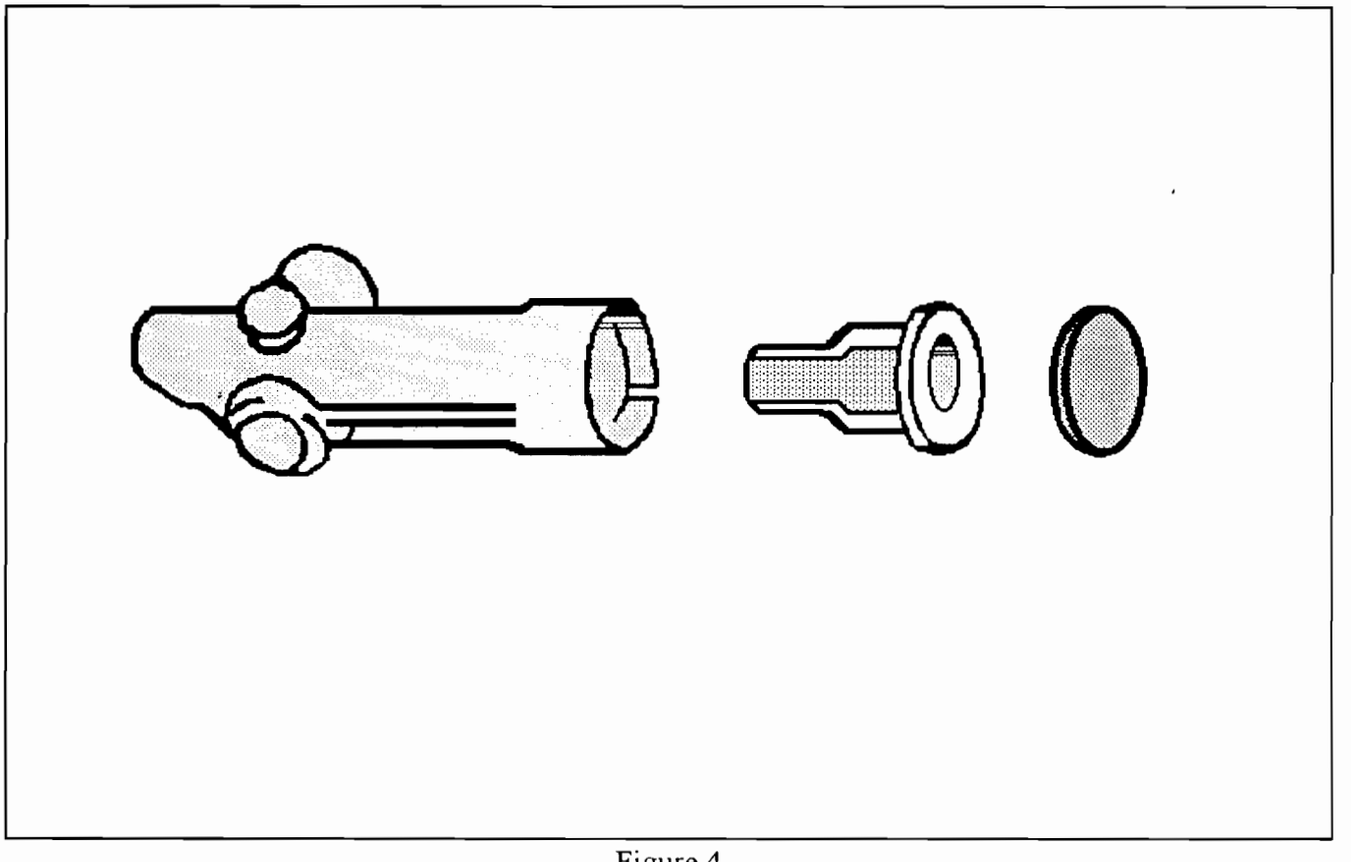


Figure 4

# KM UNITS
## ERRATIC SHIFTS

Complaint: After overhaul the transaxle may experience erratic shift patterns and the electrical system checks good.

Cause: One cause may be that during overhaul the wrong sun shell was replaced. 3 speed KM units use a 4 hole sun shell for pulse generator A signal while all 4 speed units use a 16 hole sun shell.

Correction: Check the original sun shell for the correct hole count and replace the sun shell with the correct application (See Figure 5).

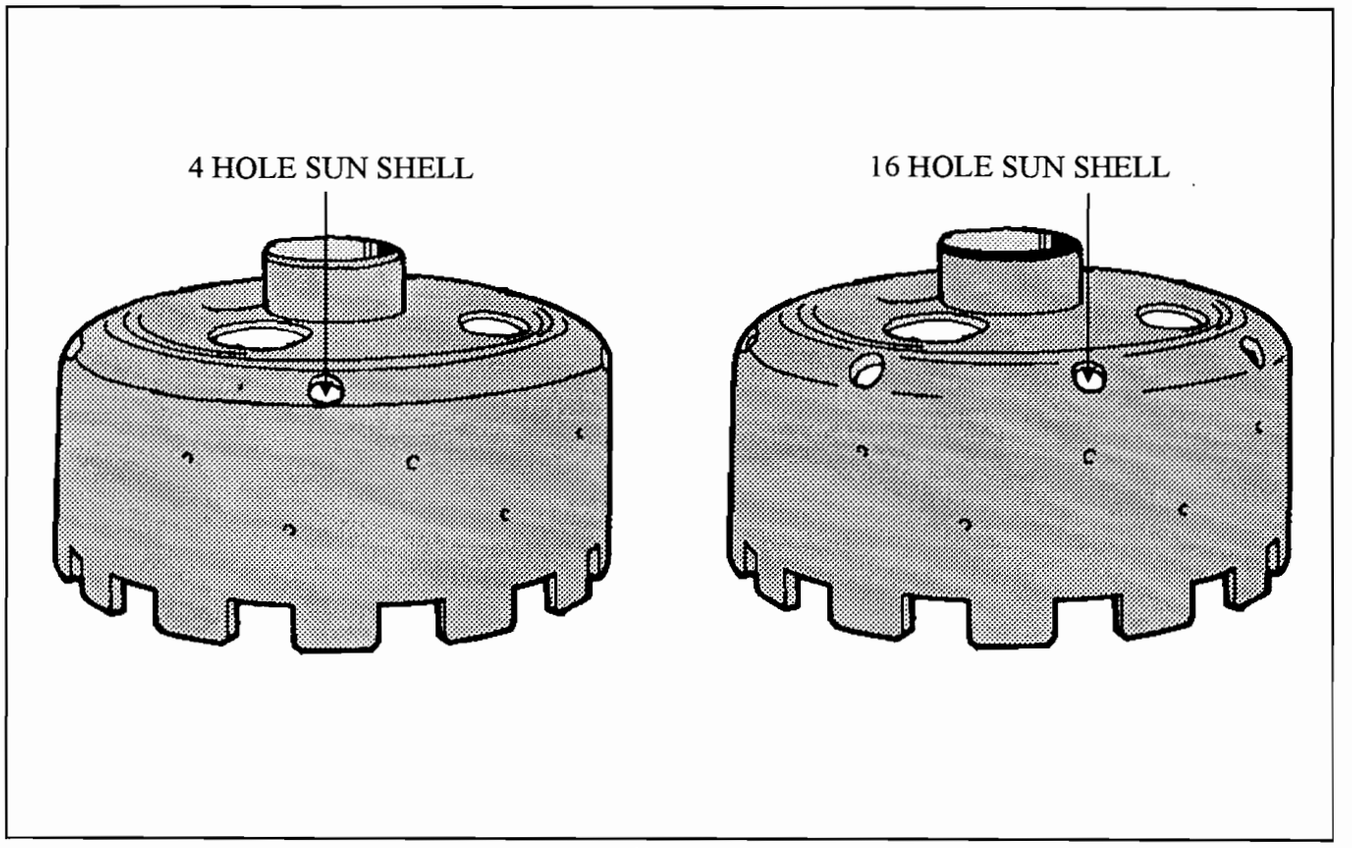



Figure 5

# F4A21,22,23,32 & 33
## NO FORWARD MOVEMENT

Complaint: After overhaul, no forward movement in any range.

Cause: One cause may be an incorrect assembly of the Neutral to Drive valve. During the valve body cleaning either the N/D plate was installed backwards or on some models, the N/D sleeve can be installed backwards. Also, there are two different style N/D valves. One style, the N/D valve measures approximately 1.796" in length while the other measures approximately 2.154" in length. Only the longer valve takes the plate at the bottom of the bore. The shorter valve does not take the plate. The bore depth is also substantially different due to the different lengths of the valve. Never put the shorter valve in where the longer valve belongs.

Correction: Use Figure 6 below for the correct N/D valve line up. Notice that the fingers on the N/D plate faces the valve and NOT the back of the bore.

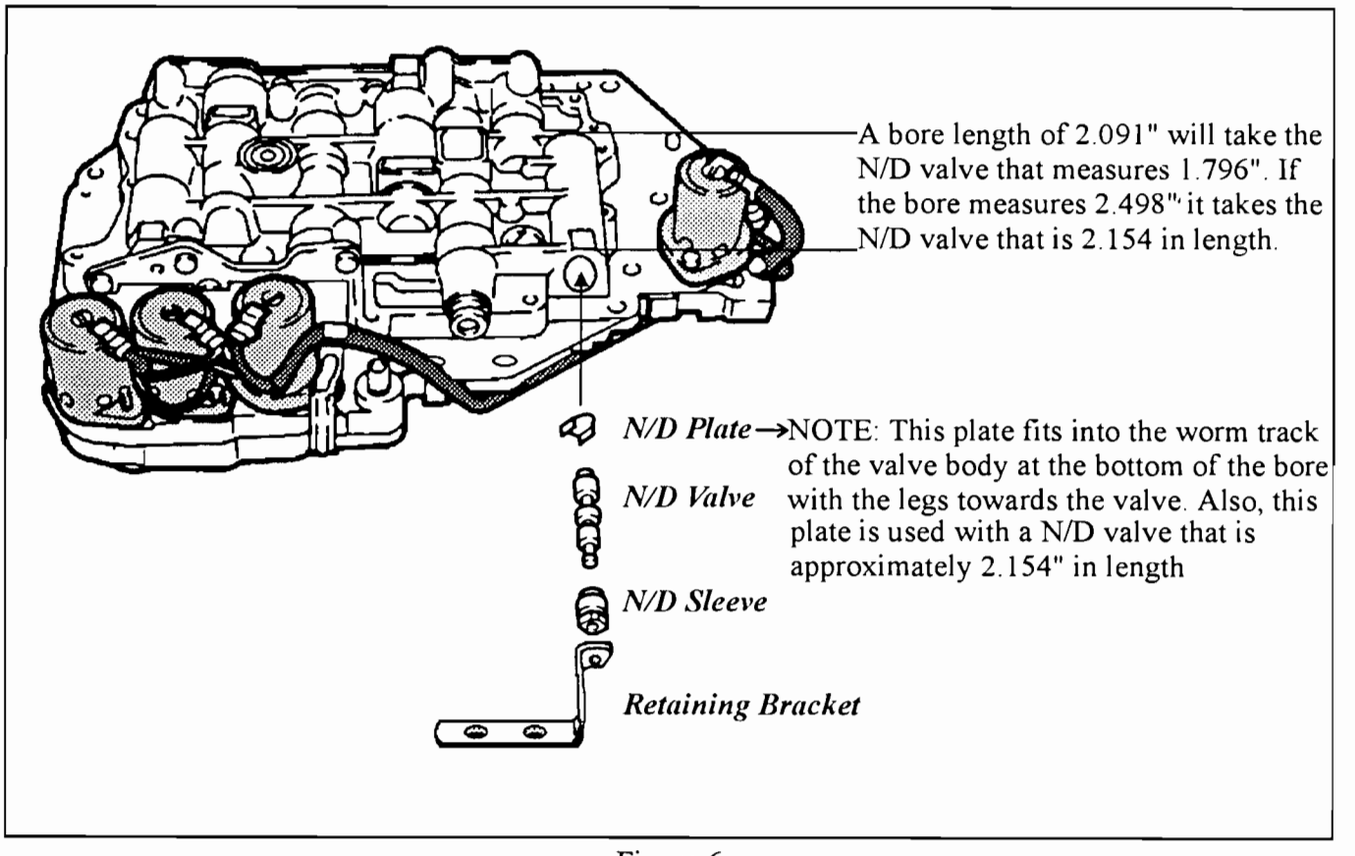



Figure 6

# ALL KM UNITS
## NEUTRALS ON A 3-4 SHIFT

Complaint: After overhaul, the unit experiences a neutral condition when a shift into 4th gear is made.

Cause: One cause may be a missing end clutch feed pipe or a missing or damaged feed pipe O ring.

Correction: Check for a missing end clutch feed pipe from the solenoid mounting block to case as shown in Figure 7. Early models had a feed pipe with two O rings on it coming out of the back of the case. Check this feed pipe for missing or damaged O rings (See Figure 7).

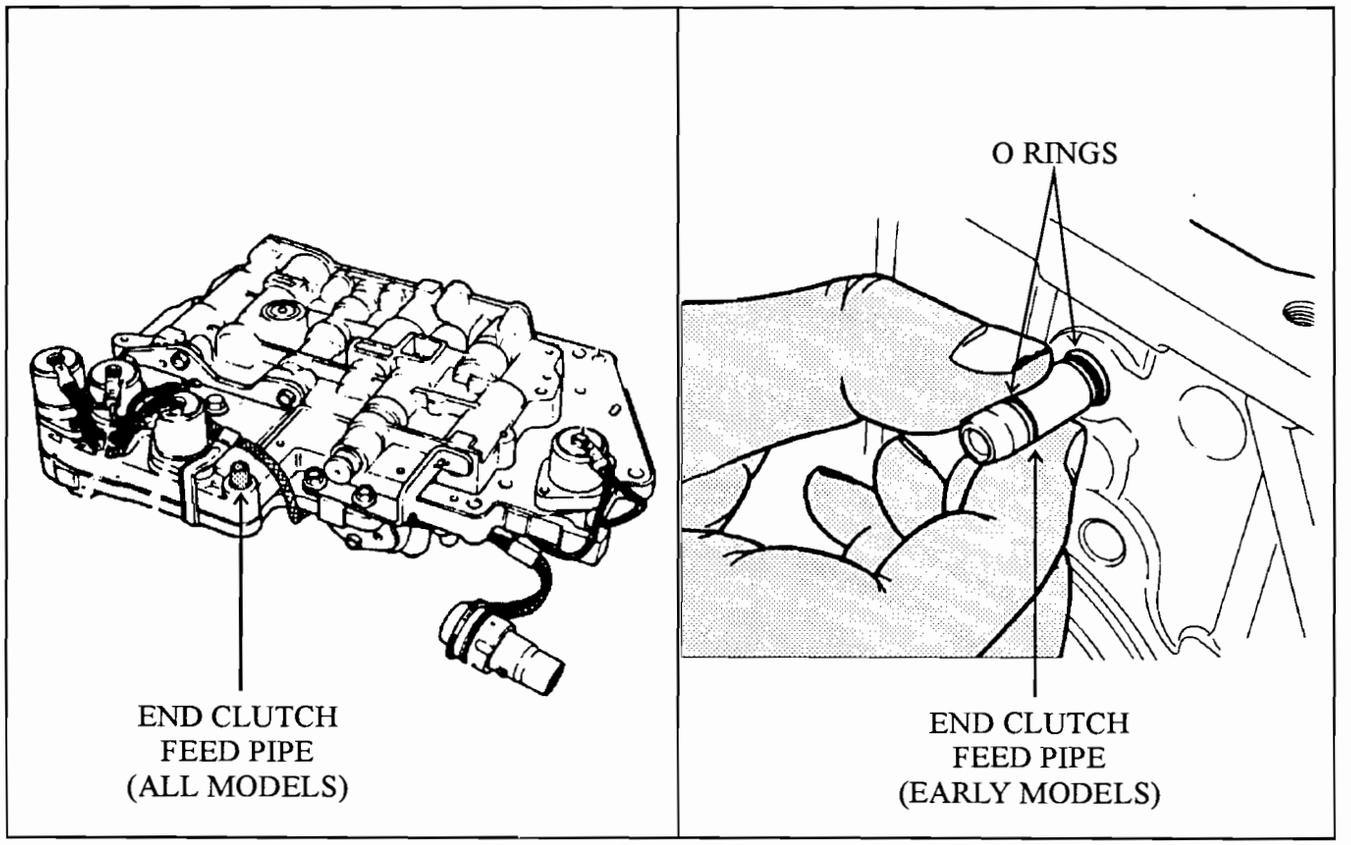
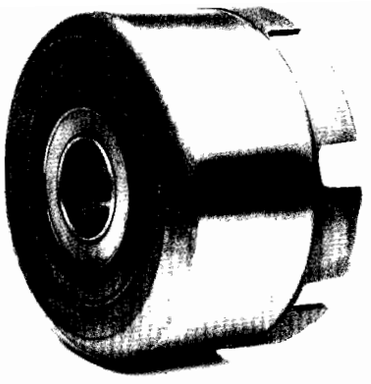



Figure 7



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# ALL KM UNITS
## HARSH REVERSE ENGAGEMENTS

Complaint: The transaxle will exhibit a harsh engagement from park into reverse, neutral to reverse, drive into reverse and/or a harsh engagement into manual low.

Cause: During the rebuilding process, the low/reverse clutch feed orifice may fall out of the valve body without the technician being aware of it. The valve body is then installed back onto the transaxle with the orifice missing providing un-orificed oil to the low/reverse clutch resulting in a harsh engagement. If the technician saw the orifice fall out of the valve body and the orifice was reassembled incorrectly, the orifice becomes ineffective resulting in the same condition.

Correction: Install the washer into the feed orifice bore first followed by the feed orifice with the legs towards the washer. Place the orifice sleeve over the orifice and press the sleeve down into the bore (See Figure 8). The design of the orifice is to control the flow rate of the low/reverse clutch oil for a controlled engagement as well as providing a rapid release of the oil when the low/reverse clutch is disengaged. The orifice used is approximately .086". If an improper orifice is used in its place, a slow release of the low/reverse clutch could be the result which would cause the low/reverse clutches to drag in forward gears causing premature failure.

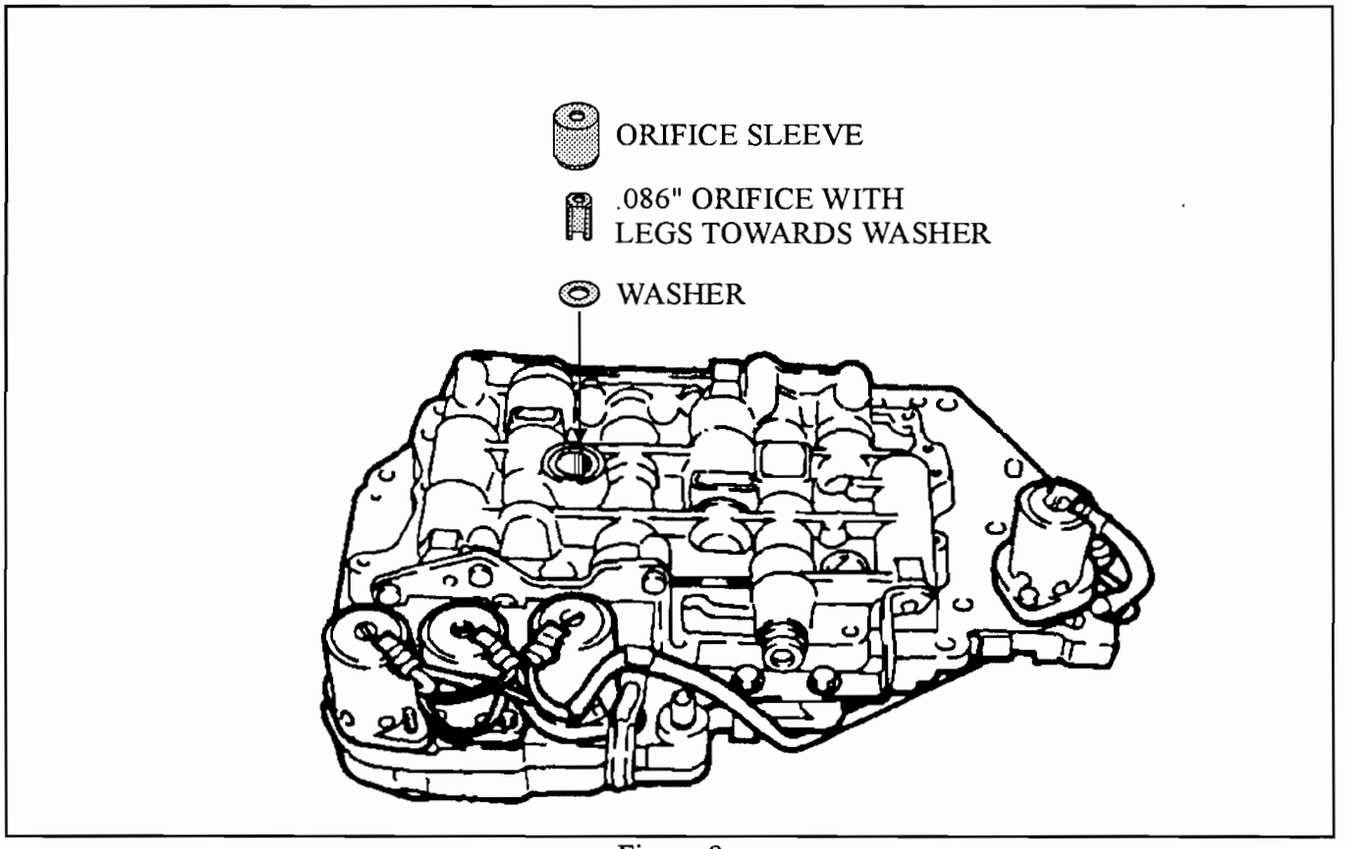


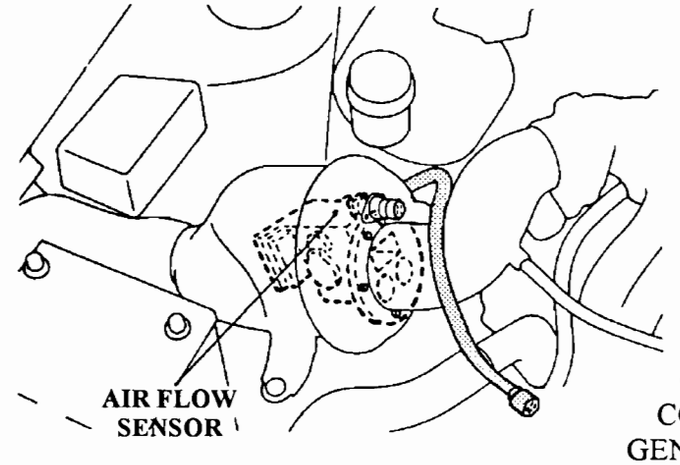

Figure 8

# 1985 to 1987
# MITSUBISHI GALANTS
## NO SHIFTS, 3rd GEAR ALL THE TIME

Complaint: After overhaul, the unit stays in 3rd gear all the time, even after the ignition has been cycled.

Cause: On 1985 to 1987 Mitsubishi Galant vehicles, the Air Flow Sensor has the same connector as the Pulse Generator connector and can be hooked up backwards (See Figure 9).

Correction: Swap the connector plugging into the Air Flow Sensor with the connector plugging into the Pulse Generators.




THE AIR FLOW SENSOR CONNECTOR HAS THE SAME CONFIGURATION AS THE PULSE GENERATOR CONNECTOR AND CAN BE HOOKED UP BACKWARDS

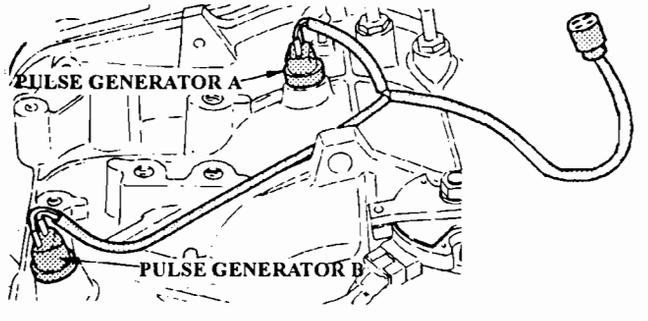



Figure 9

# F4A 21,22,23,32 & 33
## NO SHIFTS, 3rd GEAR ALL THE TIME

Complaint: After overhaul, the unit stays in 3rd gear all the time, even after the ignition has been cycled.

Cause: Some F4A units have the same connector configurations for both the pulse generators and solenoids. This allows the opportunity to plug the external harness into the wrong transaxle connectors (See Figure 10).

Correction: Swap the external wiring harness connector plugged into the pulse generator connector with the solenoid connector.

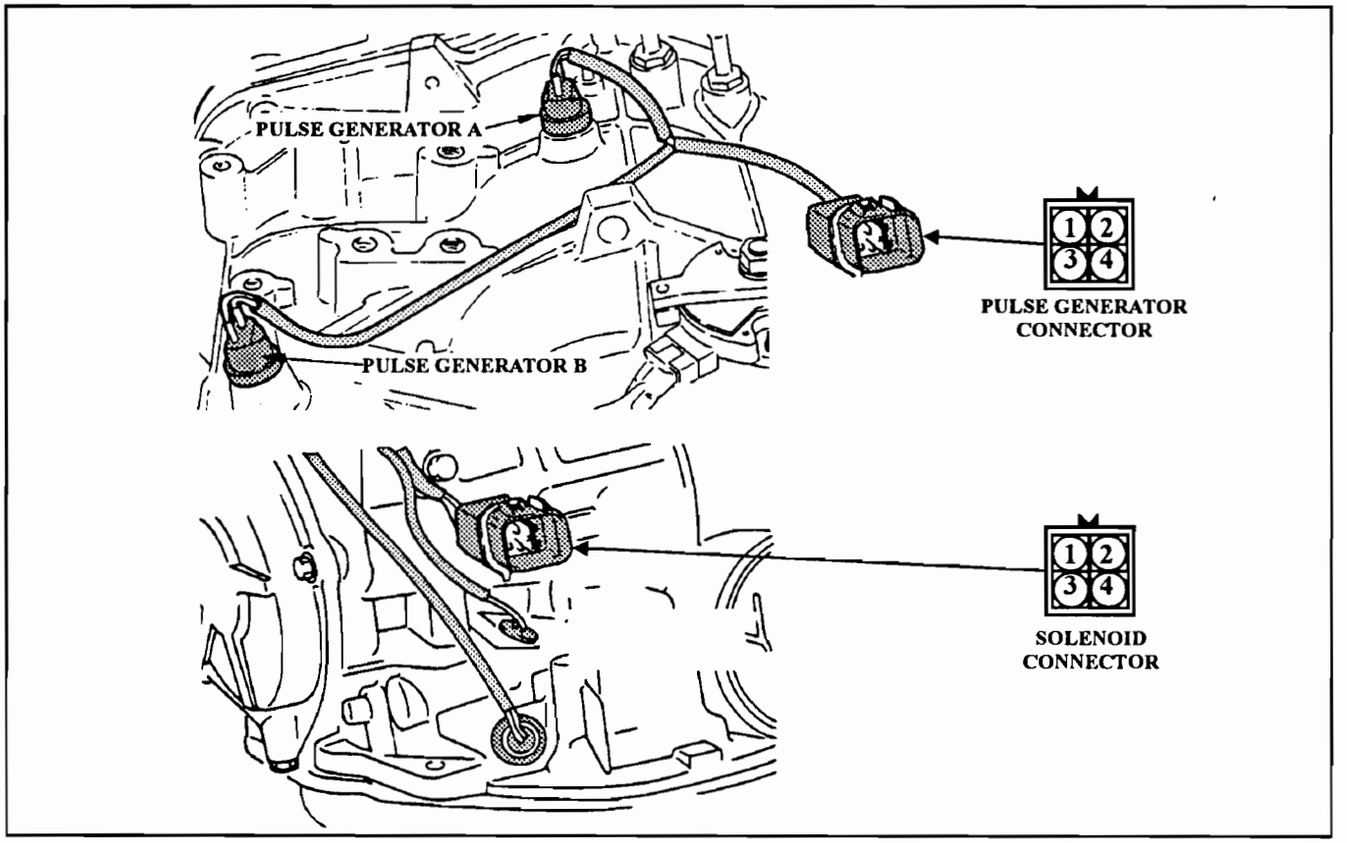


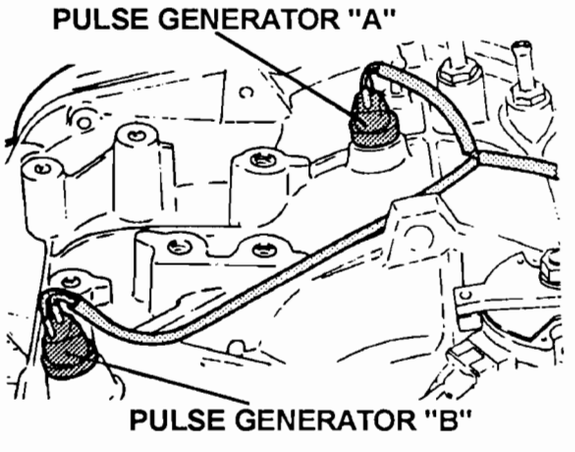

Figure 10

# KM 175, 176, 177, F4A 21, 22 & 23
## ERRATIC SHIFTS AND/OR FAILSAFE

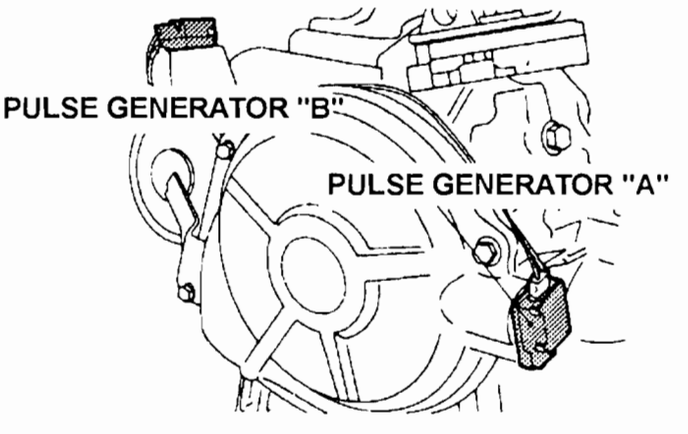
Complaint: After an exchanged unit has been installed, the vehicle may experience slid shifts into 2, erratic shifts, failsafes into third with possible non-synchronous codes stored or pulse generator A code stored.

Cause: The wrong design transaxle was installed and the TCU does not receive the proper pulse generator A signal. 1985 to 1992 transaxles had pulse generator A sending a pulse signal from the sunshell to the TCU. The sunshell would stop moving in 2nd and 4th gears when the band is applied. In 1993, pulse generator A was moved to the end cover to read turbine shaft speed. The turbine shaft is constantly sending an rpm reading via the pulse generator in all forward and reverse movement. When this second design transaxle (Pulse Generator A reading the turbine shaft) is installed in a first design vehicle, the TCU receives a signal in 2nd and 4th gears and interprets this signal as a slip. When the first design transaxle is installed in a late design application, pulse generator A provides a 0 rpm signal to the TCU in 2nd gear. The TCU failsafe's the transaxle to third gear.

Correction: Identify the year of the vehicle by build date and install the proper transaxle. 1985 to 1992 have pulse generator A reading the sun shell. 1993 and up have pulse generator A in the end cover (See Figure 11).




*1985-1992 Pulse Generator Locations*




*1993 and up Pulse Generator Locations*

Figure 11

# ALL F4A3 UNITS
# LATE F4A21, 22, 23
## NO REVERSE

Complaint: F4A33 and select KM 175-5 units may experience a no reverse condition after overhaul.

Cause: One cause may be that the pulse generators have been installed backwards. The qualification is that this is only applicable with units that have the pulse generator A moved to the end cover to read the turbine shaft (See Figure 12). With the pulse generators plugged in backwards, pulse generator B is now reading the turbine shaft and the computer thinks the vehicle is moving forward when reverse is selected. A safety design is built into the TCU to prevent reverse from engaging while a forward motion is detected.

Correction: Swap the pulse generator wires so that the solid green wires go to the end cover and the solid black wires goes to the top of the case (See Figure 12).

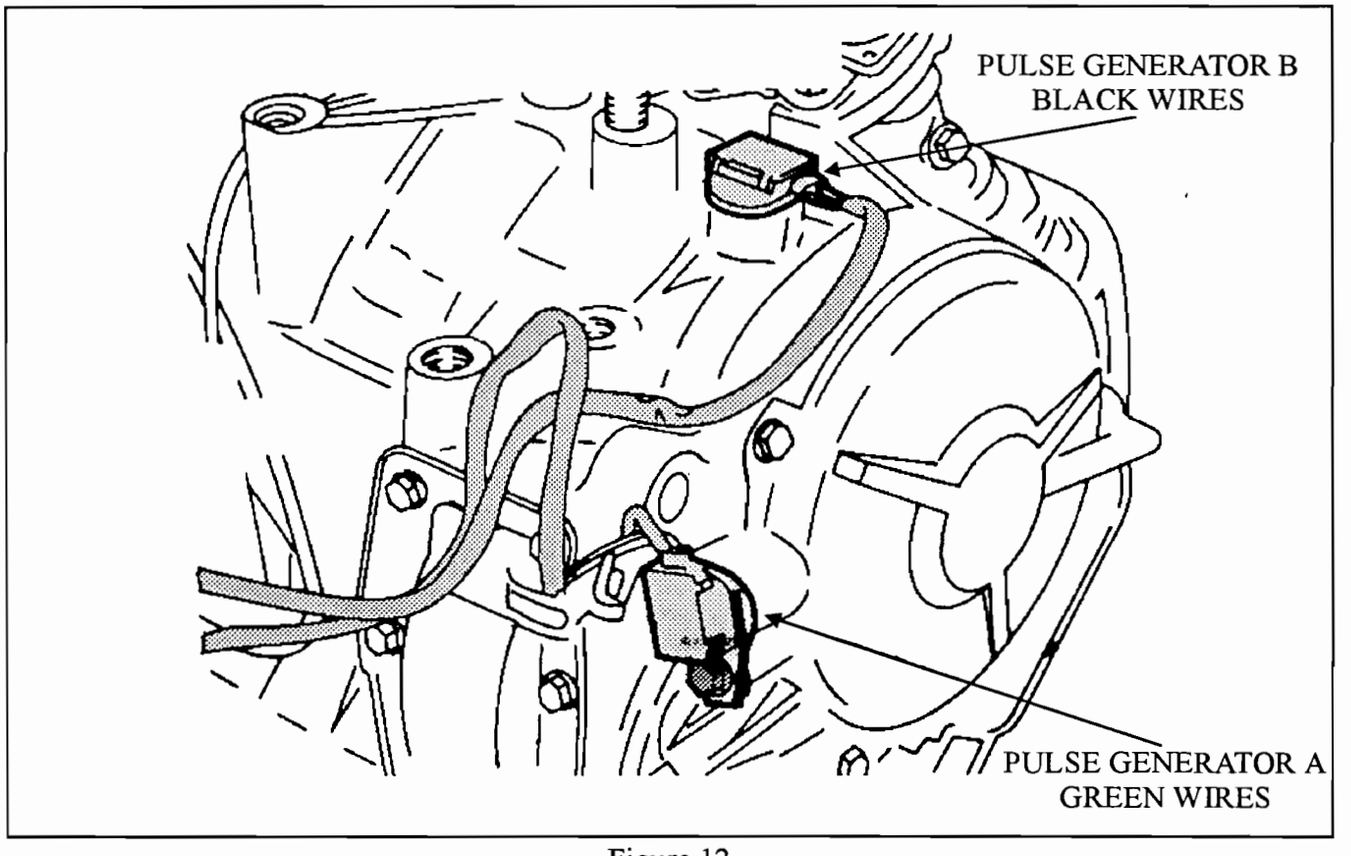



Figure 12

# ALL KM UNITS
## SHIFTS 1st to 4th to 3rd to 2nd

Complaint: After overhaul, the transaxle starts in first, shifts to 4th then to 3rd and then to 2nd.

Cause: One cause may be that shift solenoid A and B have been mis positioned.

Correction: Swap shift solenoids A and B. On Mitsubishi and Chrysler units, shift solenoid A can be identified with an orange wire and shift solenoid B has a yellow wire. Hyundai units use a blue wire with a black stripe for shift solenoid A and a red wire for shift solenoid B (See Figure 13).

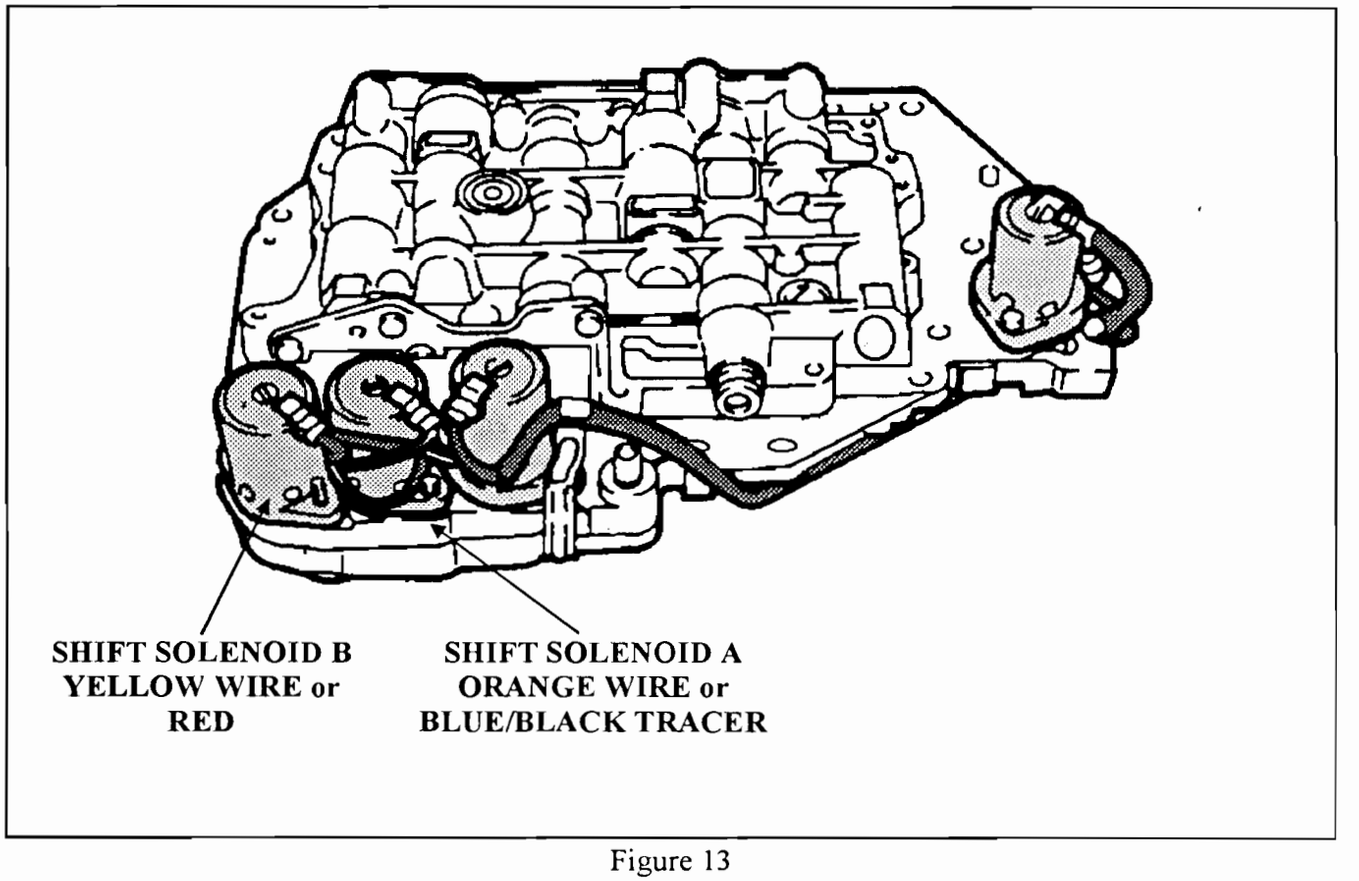



Figure 13

# ALL KM UNITS
# EXCEPT KM 177's
## STALLS WHEN ACCELERATOR IS DEPRESSED

Complaint: After overhaul, the transaxle stalls when the accelerator pedal is depressed.

Cause: One cause may be that shift solenoid A and the damper clutch control solenoid have been mis positioned. When the accelerator pedal is not depressed, the TCU energizes shift solenoid B to put the transaxle in 2nd gear. This prevents engine creeping when stopped. As soon as the accelerator pedal is depressed, the TCU energizes shift solenoid A for a first gear take off. If shift solenoid A was placed in the damper clutch control solenoid location, this would engage the converter clutch and stall the engine.

Correction: Swap shift solenoid A and with the damper clutch control solenoid. Shift solenoid A can be identified with either and orange wire or a blue with a black tracer wire. The damper clutch control solenoid can be identified with either a red wire or a blue wire. Another way of identifying the two is by their resistance values. Both shift solenoids measure 20 to 25 ohms while the damper clutch and pressure control solenoid measure 2 to 5 ohms (See Figure 14).

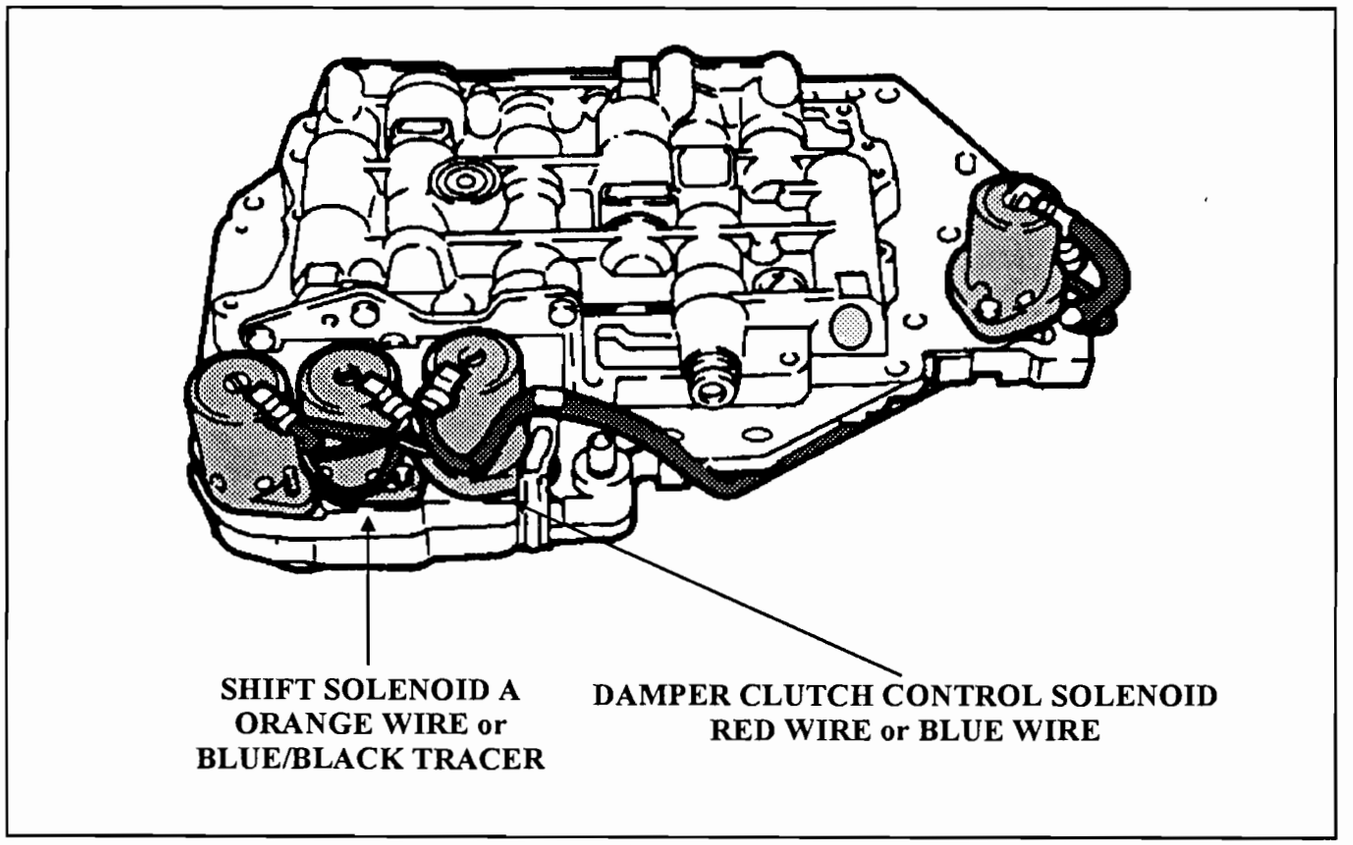



Figure 14

# ALL KM UNITS
## COAST DOWNSHIFT CLUNK

Complaint: The vehicle has a coast downshift clunk into first gear

Cause: The accelerator switch is out of adjustment or defective. Another possible cause is that the driver is keeping their foot rested on the accelerator pedal. The reason is that the TCU is programmed to prevent a coast downshift into first gear when coming to a stop. When the accelerator pedal is released and the brake is being applied, the transaxle will coast down to second gear and stay in second gear when stopped to reduce engine creeping. When the accelerator pedal is depressed, the switch indicates this action to the TCU and the computer immediately puts the transaxle into first gear for take off. If the accelerator switch is defective, out of adjustment or being constantly depressed, the transaxle will coast down and clunk into first gear when coming to a stop.

Correction: Check the switch for proper operation by placing an ohm meter across terminals 1 and 2 as shown in Figure 24 below. Continuity should be seen with the pedal released and go to open when the pedal is depressed approximately 5%. The switch can be adjusted using the adjustment bolt shown in Figure 15. If the switch can not be adjusted, replace the switch.

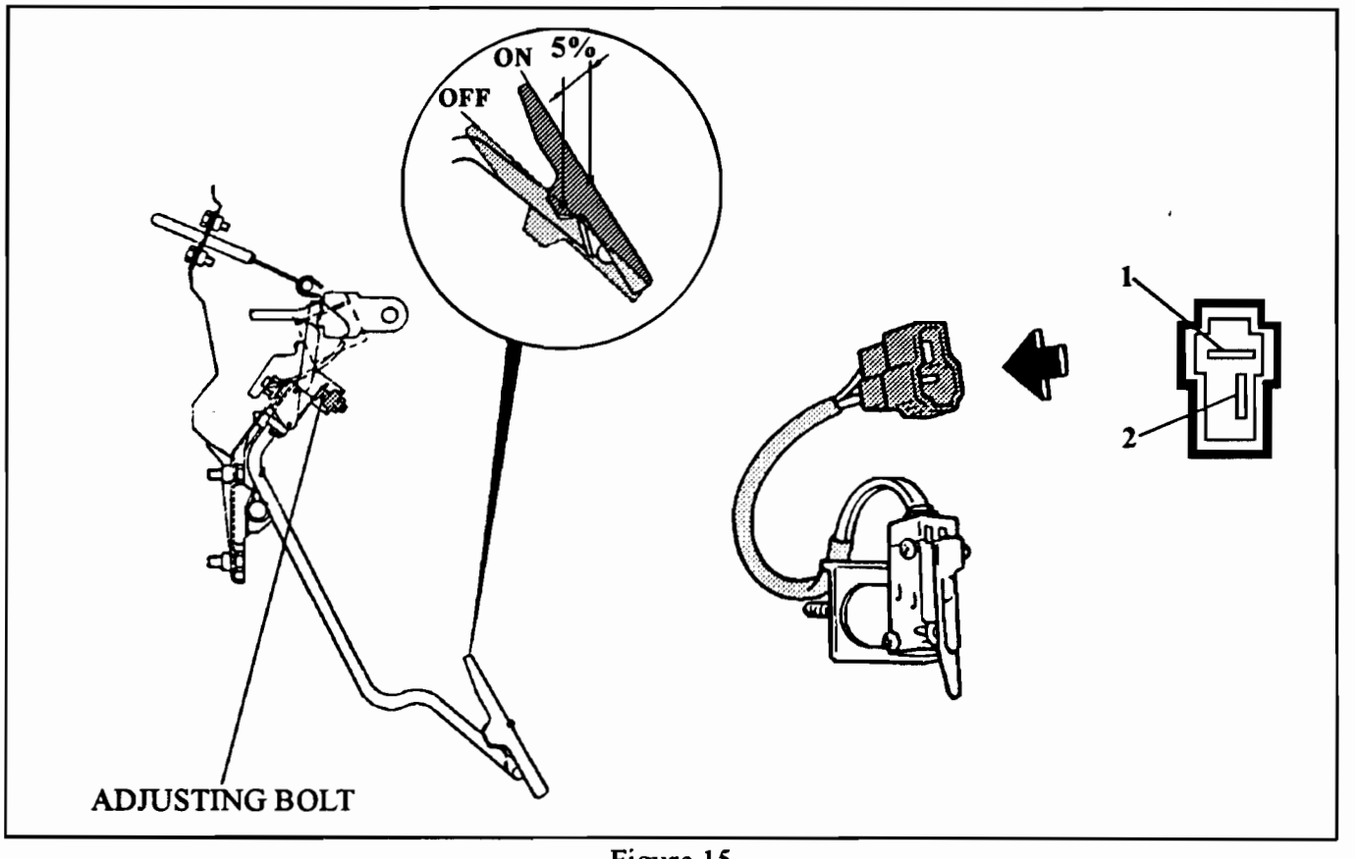



Figure 15

# REVERSE SELECTOR
## GRINDING DURING GARAGE SHIFTS

COMPLAINT: Transaxle grinds when shifting from drive into reverse and/or continues to grind after the shift lever is placed into park.
Transaxle grinds when shifting out of reverse.

CAUSE:
1- The number one cause is incorrect shaft end clearance.
2- Clutch pack clearance to tight.
3- Over tightening of the shaft nuts.
4- Cotters fell out of place during assembly
5- Distance collar or spacer installed upside down.
6- Friction, steel, fluid incompatibility
7- Misadjusted or faulty external linkage, causing manual valve to be out of position.
**8- A worn servo body.**
9- Grooves cut into the 4th clutch drum by the steel plate lugs or Grooves cut into the 4th clutch hub by the friction plate teeth.
10-A broken cushion plate jamming the 4th clutch on.
11-Incorrect installation of the reverse selector assembly or it is damaged.
12-Main ball bearing snap ring has worn the snap ring groove in the case, causing the entire shaft assembly to move up and down in the case.
13-The use of a rebuilt 2-4 drum that has had the center hub replaced and welded at an incorrect height.
14-A dragging converter clutch.

CORRECTION:
1-Make certain end clearance is .003-.006 on early models and 002-.005 on late models.
2-All clutch clearance should be set at .032, EXCEPT 4th clutch which is set at .039.
3-Follow torque specifications for shaft nuts.
4-Use a generous amount of assembly grease to hold the cotters in position.
5-Follow assembly illustrations in the appropriate service manual.
6-Use GOOD quality frictions, Replace steel plates or sand them with 240 grit sandpaper, Use Honda fluid or an additive such as LubeGard® in the BLACK bottle.
7-Make certain Linkage is adjusted properly and is tight.
**8-Check clearance between reverse servo shaft and servo body and replace servo body if necessary. (Refer to figures 16 and 17)**
9-Replace drum or clutch hub as necessary.
10-Replace cushion plate .
11-Make certain that the reverse selector hub and slider are installed right side up.
12-Replace case half.
13-Compare the height of the center hub to that of the original drum.
14-Replace converter or free stuck valve or repair electrical fault if so equipped.

# REVERSE SELECTOR
## FORWARD RANGE

The position shown below is with the reverse selector engaged with the 4th gear. This is its position in all forward gears, park and neutral.
The 4th clutch apply circuit is open to exhaust, forward servo apply oil keeps the selector engaged with the 4th gear and the servo release checkball is seated.
When the engine is not running, the spring or detent assembly will keep the selector engaged with the 4th gear.

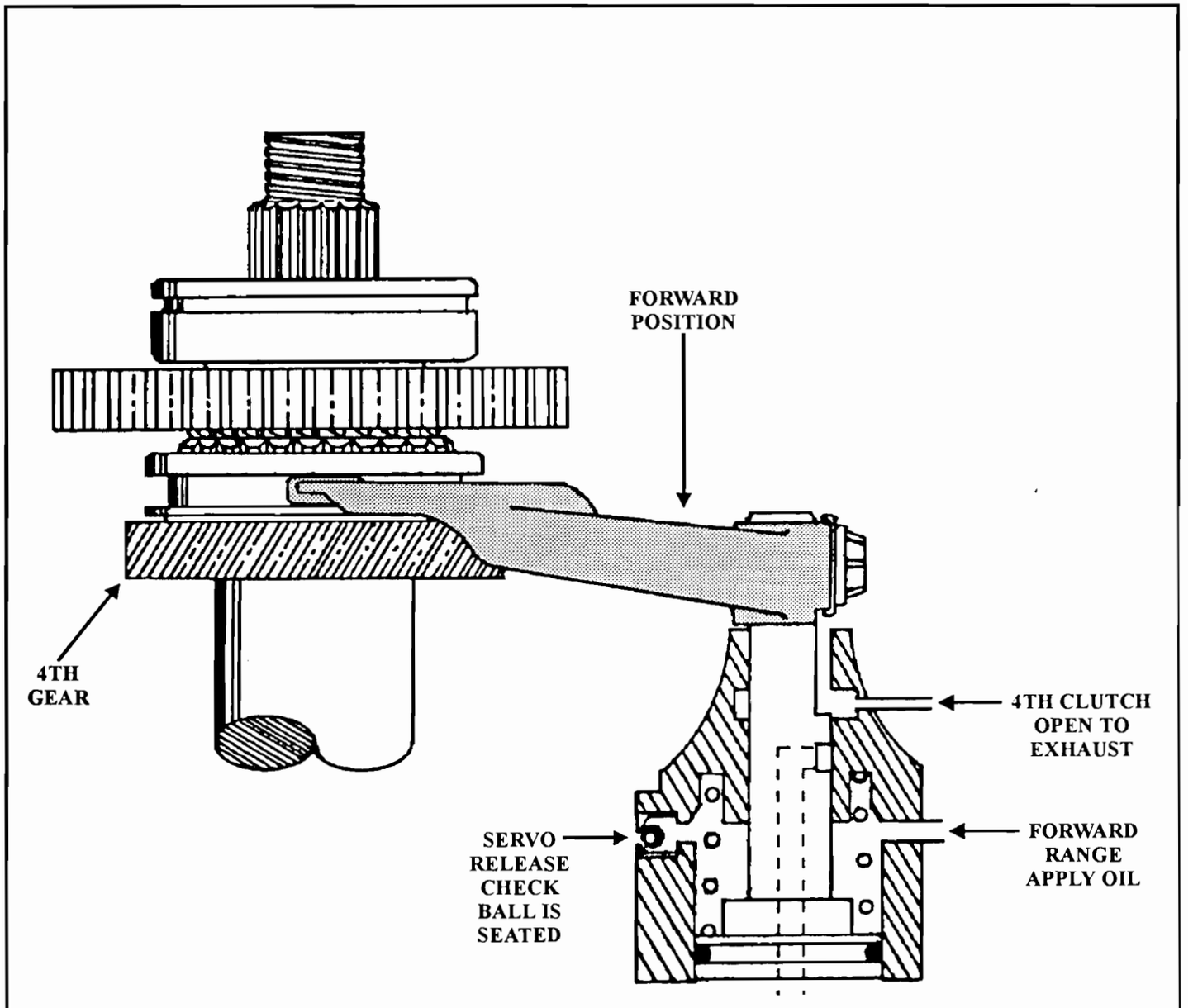
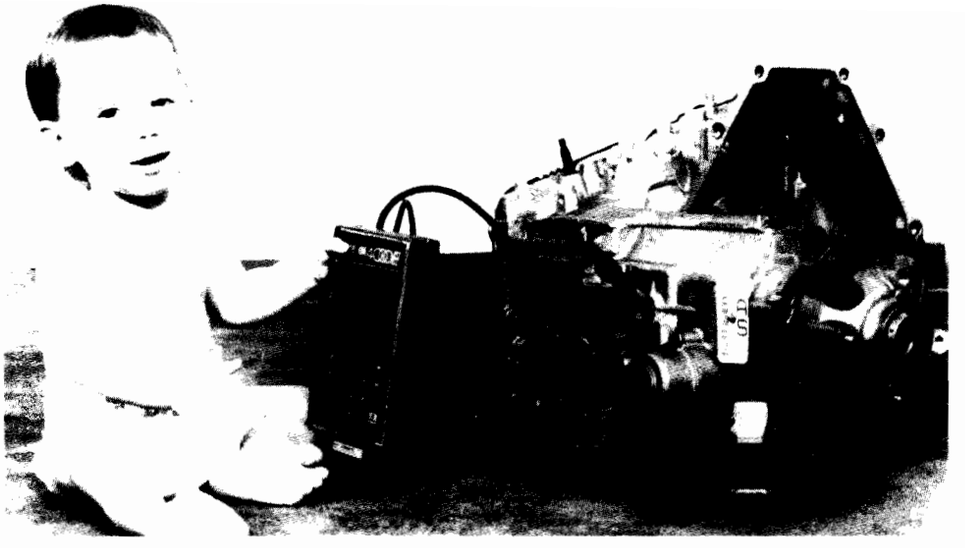



Figure 16



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**Miami. FL 33156**

# REVERSE SELECTOR

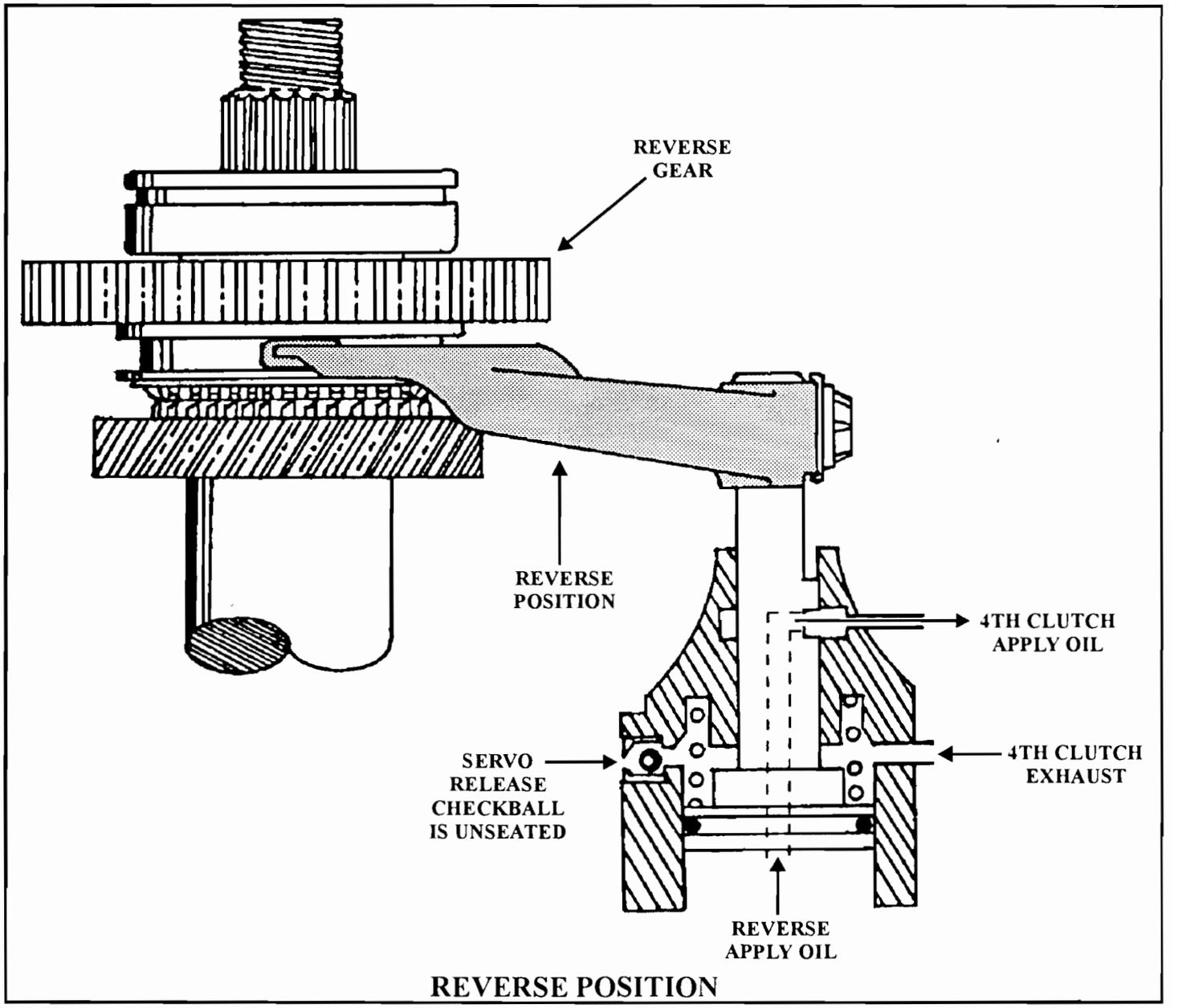
## REVERSE RANGE

When reverse is selected, oil from the manual valve is sent to the bottom of the reverse servo which moves the reverse selector up where it engages the reverse gear.

The servo release checkball is unseated and as the servo piston approaches the reverse position the 4th clutch feed hole in the servo shaft will line up with the 4th clutch apply hole in the servo body and reverse gear is achieved.

When the manual shift lever is moved out of the reverse position the servo piston will move down towards the 4th gear and at the same time will open the 4th clutch to exhaust.

At this time, if there is significant leakage between the servo shaft and the servo body, 4th clutch oil will not be able to exhaust and the 4th clutch will not be able to release which will keep the mainshaft engaged resulting in




**REVERSE POSITION**

Figure 17

# VEHICLE SPEED SENSORS
## IN-DASH SPEED PULSER

The example shown here is a 1989 Prelude and is the type of vehicle speed sensor located in the speedometer cluster. (Refer to figure 18)
The best way to check this speed sensor is to locate the terminal in the transaxle computer that the speed sensor is wired to and with the multimeter set on DC VOLTS, rotate front wheels by hand, the voltage seen should pulse from 0 to 5 volts.
In this example the positive multimeter lead would go to **A6** which is the speed pulser wire and the negative lead would go to **B1** which is the computer ground. (Refer to figure 19)

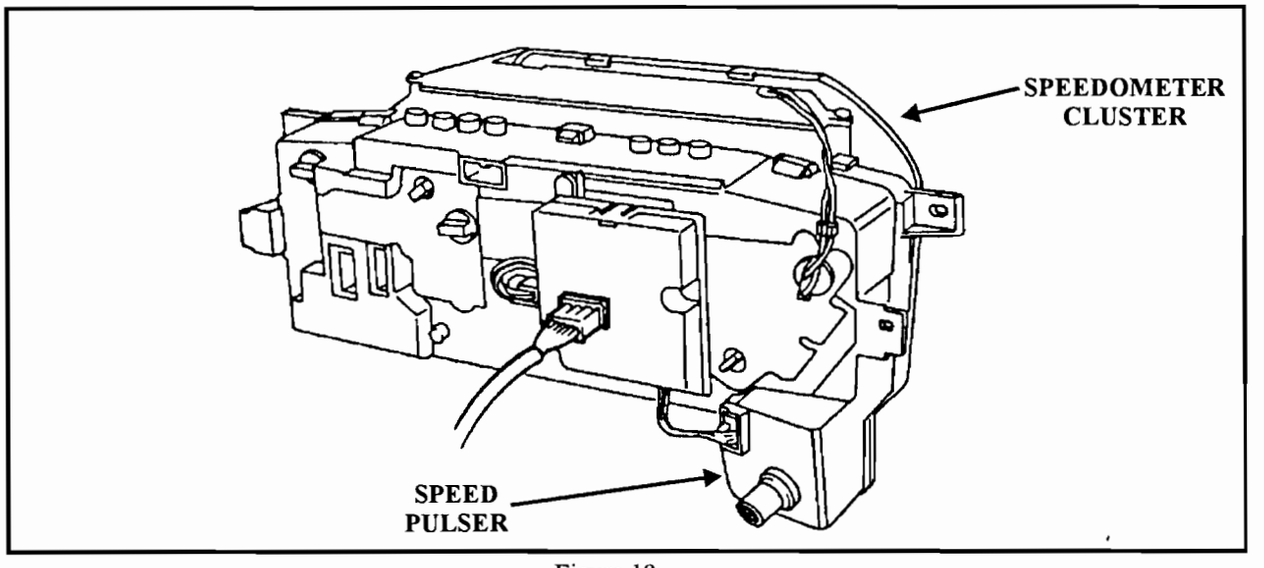



Figure 18

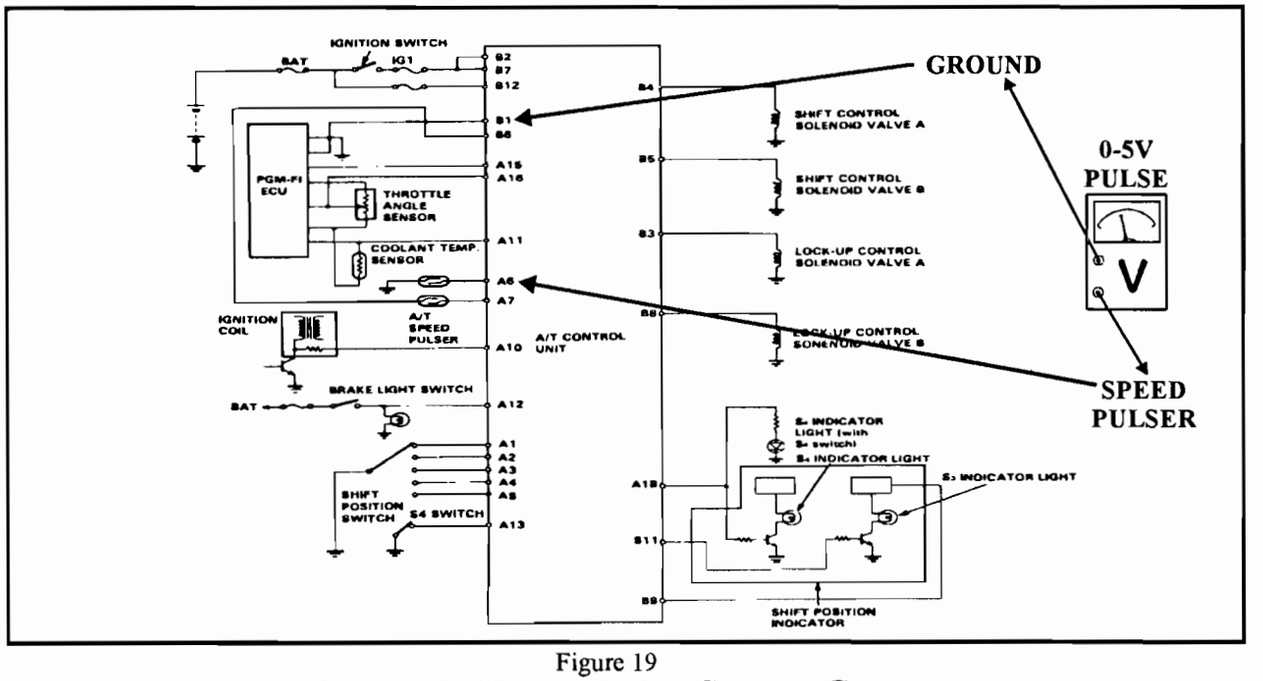



Figure 19

# SPEED SENSORS
## A/T SPEED PULSER

This 2 wire type of speed sensor can be checked with an ohm meter. The meter will pulse whenever the rotating magnet passes the pick-up and the reed switch inside opens and closes. The voltage pulse is 0-5 volts DC. The ohm pulse is INFINITY to 100 ohms. (Refer to figure 20)

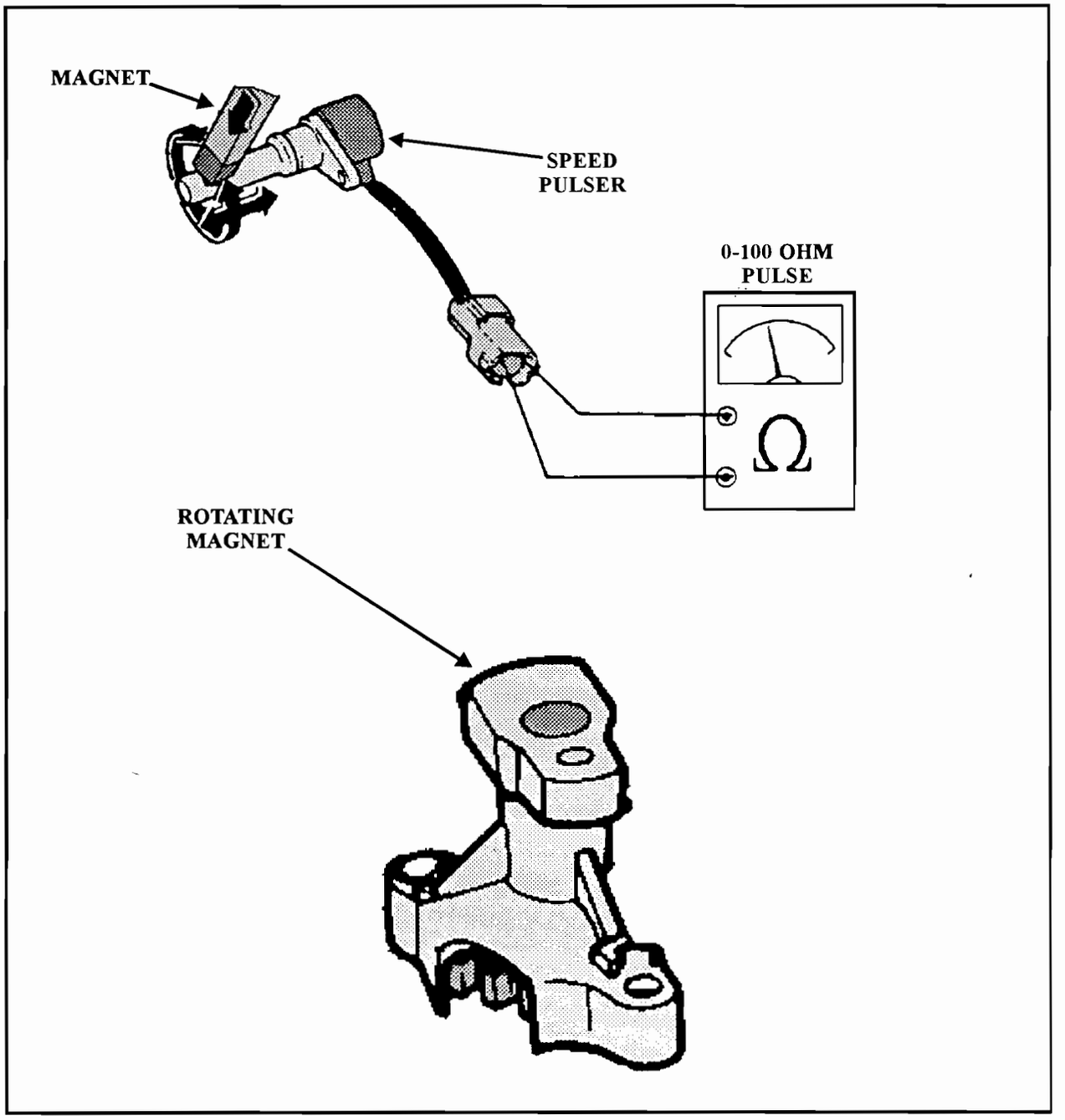



Figure 20

# SPEED SENSORS
## VSS MECHANICAL

This type of speed sensor is gear driven by the differential ring gear and produces a pulsed signal as it rotates which opens and closes the reed switch inside it.
This pulsed signal will pulse 4 times for 1 revolution of the wheels.
This type of speed sensor can be checked with a volt meter set on DC VOLTS with the connector plugged in and ignition key on which will show a value of 0-5 VOLTS.
Typically 3 wire VSS must have power to excite the circuitry inside them unlike the 2 wire style.
Therefore it is necessary to check this type of VSS connected with the ignition key on.
Typically this sensor will have a 12 volt power supply, a signal return and a ground wire.
The volt meter should be connected between the signal return and ground where a 0-5V pulse should be seen. ( Refer to figure 21).

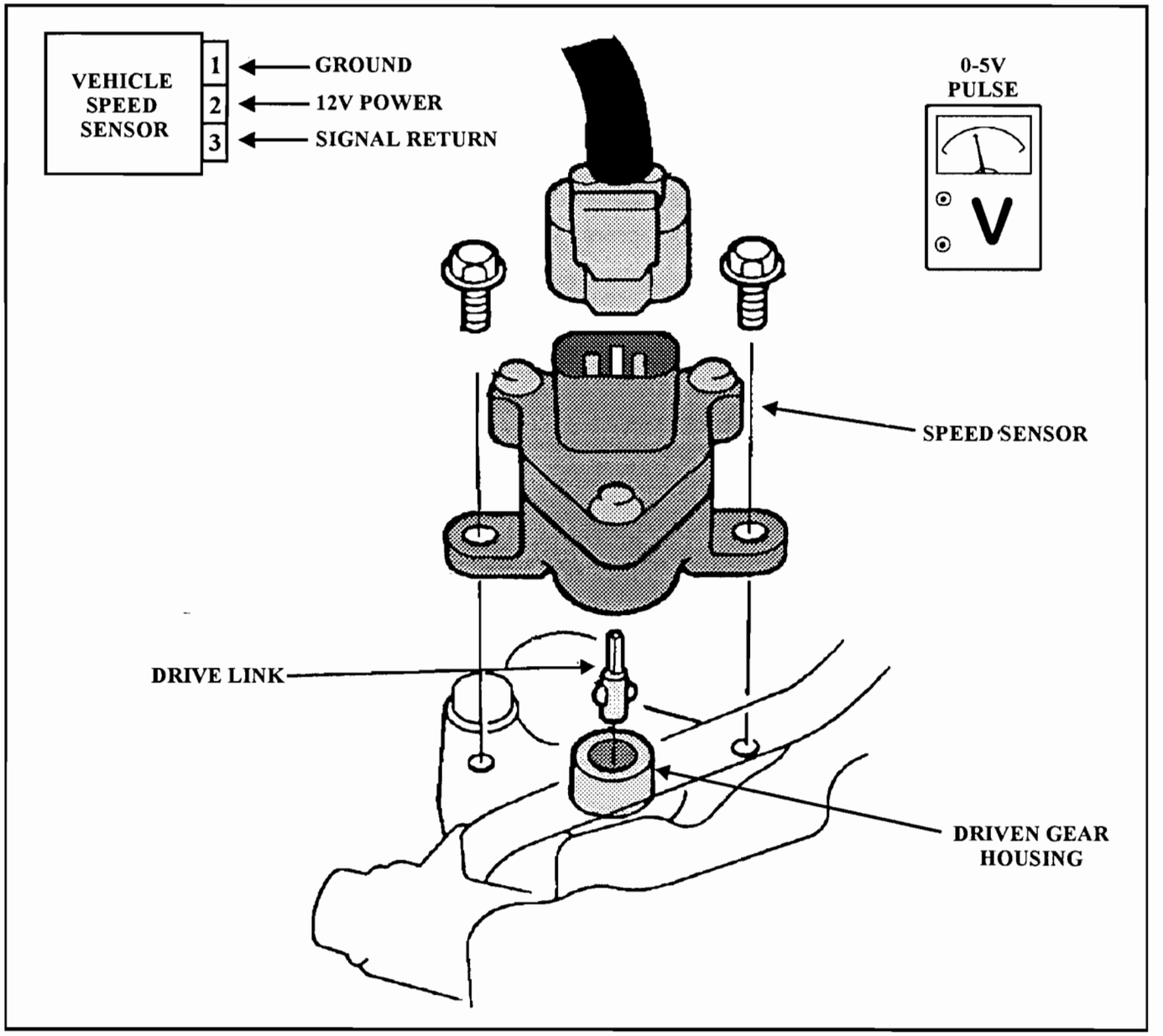



Figure 21

# SPEED SENSORS
## VSS HYDRAULIC

This 3 wire speed sensor is checked the same way as the mechanical speed sensor on the previous page.
The difference is, this speed sensor is used by the power steering pump to control the gain valve in order to control steering effort under varying conditions. (Refer to figure 22)

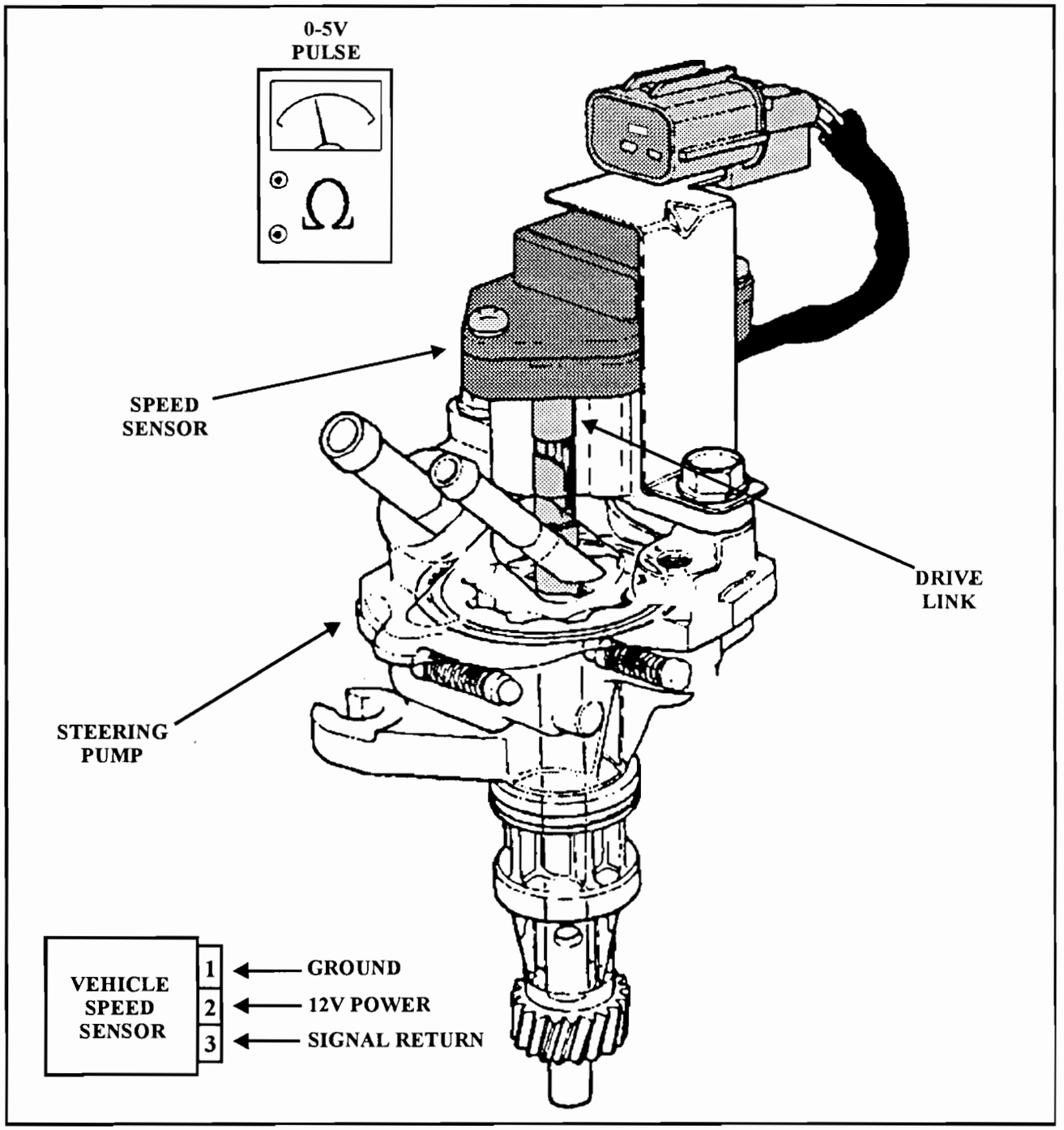



Figure 22

# A/T SPEED SENSORS
## AC GENERATORS

This type of speed sensor generates its own signal when a toothed exciter ring rotates in front of it. This type of speed sensor is checked with a volt meter set on AC volts or with a multi-meter set on HERTZ. (Refer to figure 23)
This type of speed sensor can also be checked with an ocilloscope, which is the most acurate method of checking AC GENERATORS. (Refer to figure 24)

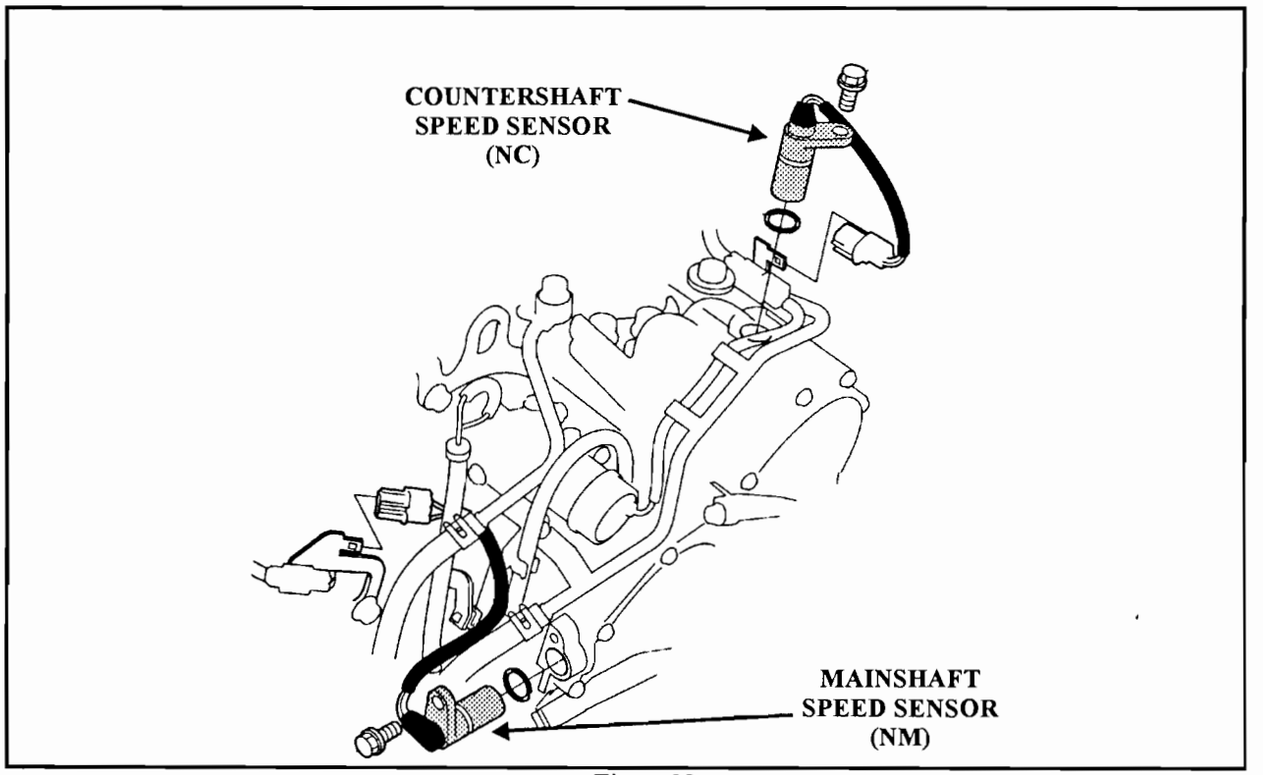



Figure 23

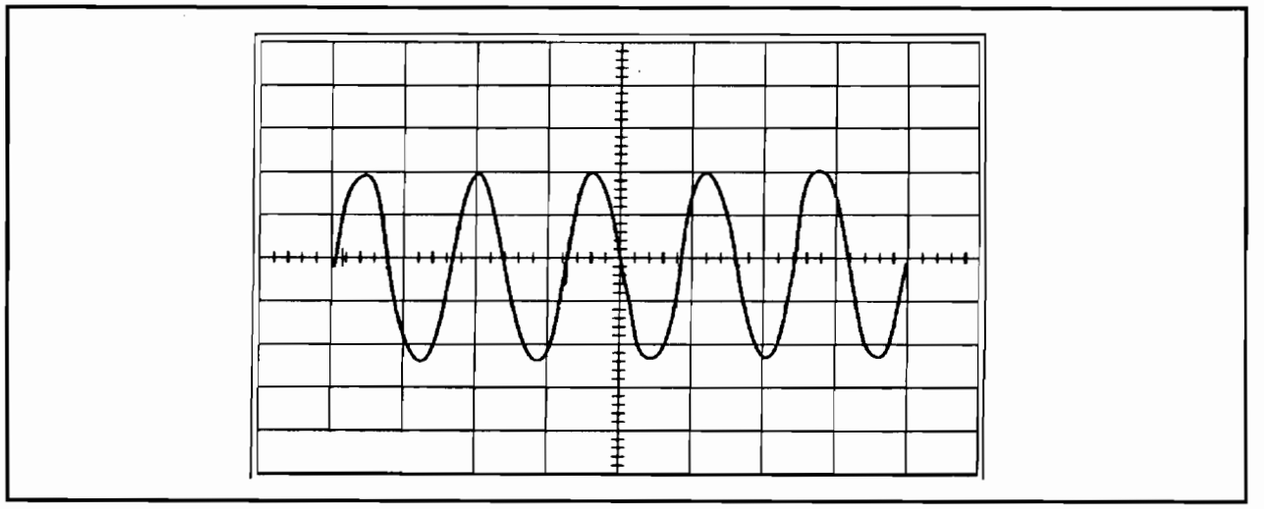


Figure 24

# HONDA/ACURA
# SOLENOID SHIFTED TRANSAXLES
## NO REVERSE

COMPLAINT: No reverse engagement when shift lever is placed in the reverse position.

CAUSE: Most solenoid shifted Honda/Acura transaxles have a REVERSE INHIBITOR feature which prevents reverse engagement should reverse be selected while the vehicle is moving forward at a speed greater then 6 mph. (Refer to figure 25) If the Vehicle Speed Sensor is faulty and is showing vehicle speed above 6 mph, causing the transaxle computer to think the vehicle is moving faster than 6 mph, reverse will be prevented because the computer will command 1st gear causing the 1-2 shift valve to block oil from operating the reverse servo and the 4th clutch.

CORRECTION: Check the VSS with a volt or ohm meter. If the meter never drops to 0 volts or Infinity on the OHMS scale when the front wheels are rotated by hand, replace the Vehicle Speed Sensor.

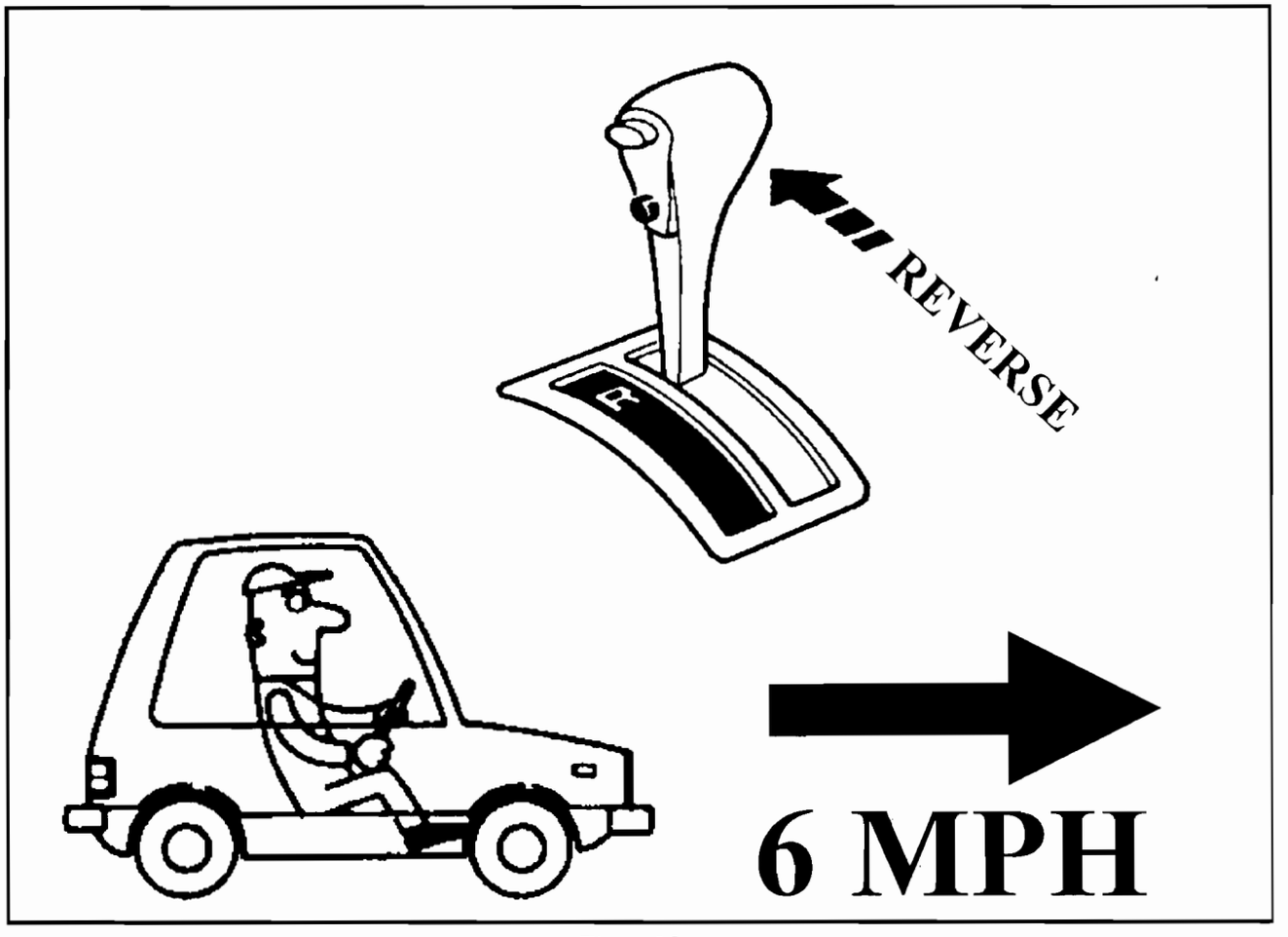



Figure 25

# HONDA/ACURA
# SOLENOID SHIFTED TRANSAXLES
## SECOND GEAR STARTS

COMPLAINT: Vehicle pulls off in second gear from a standing start. Stop lights may be on at all times.

CAUSE: This can be caused by a faulty stop light switch. On most solenoid shifted Honda/Acura transaxles the A/T Control Unit will command 2nd gear when the brake pedal is depressed, thereby preventing vehicle creep. If the stop light switch is stuck on, the A/T Control Unit will not command 1st gear when the brake pedal is released, causing the vehicle to pull off in 2nd gear.
The stop lights may also remain on even though the brake pedal is released.

CORRECTION: Check for battery voltage at terminals "B" and "C" at the stop light switch connector as shown in figure 26. If battery voltage is present when the brake pedal is released, check the "B" and "C" wires for a short to power. If none exists, replace the stop light switch.

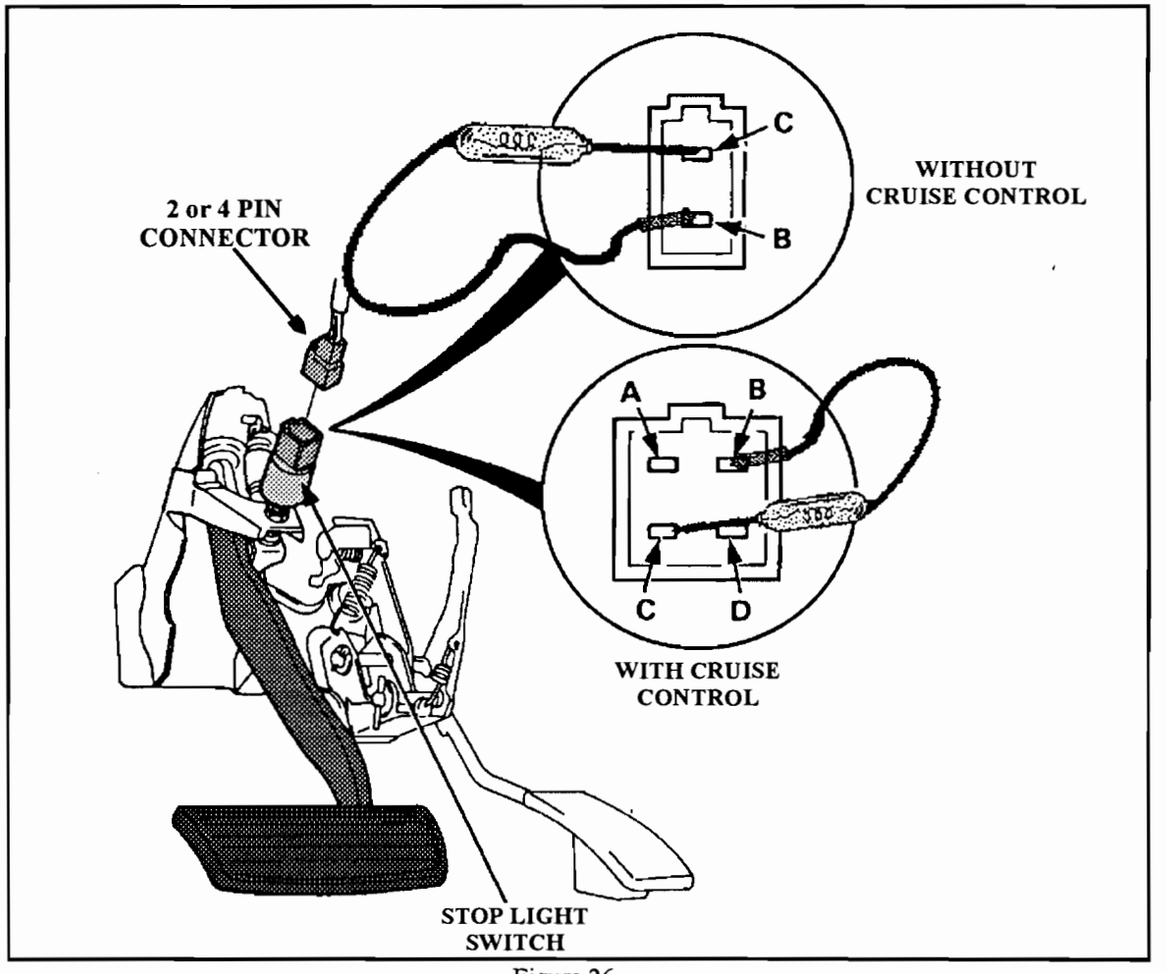



Figure 26

# HONDA APX4
# 1992-93 ONLY
## BIND-UP IN REVERSE

COMPLAINT: After an overhaul the transaxle is bound up in reverse. All other gear positions are normal.

CAUSE: The 32mm cotter retainer located on the countershaft has been installed upside down (Refer to figure 27) causing all endplay in the countershaft to be removed.
The countershaft is now bound up resulting in a reverse bind-up condition.

CORRECTION: Install the cotter retainer so that the cotters fit inside the retainer. (Refer to figure 27)

NOTE: This condition cannot occur on a 1991 APX4 because it does not utilize the split cotters or the retainer in this location. (Refer to figure 28)

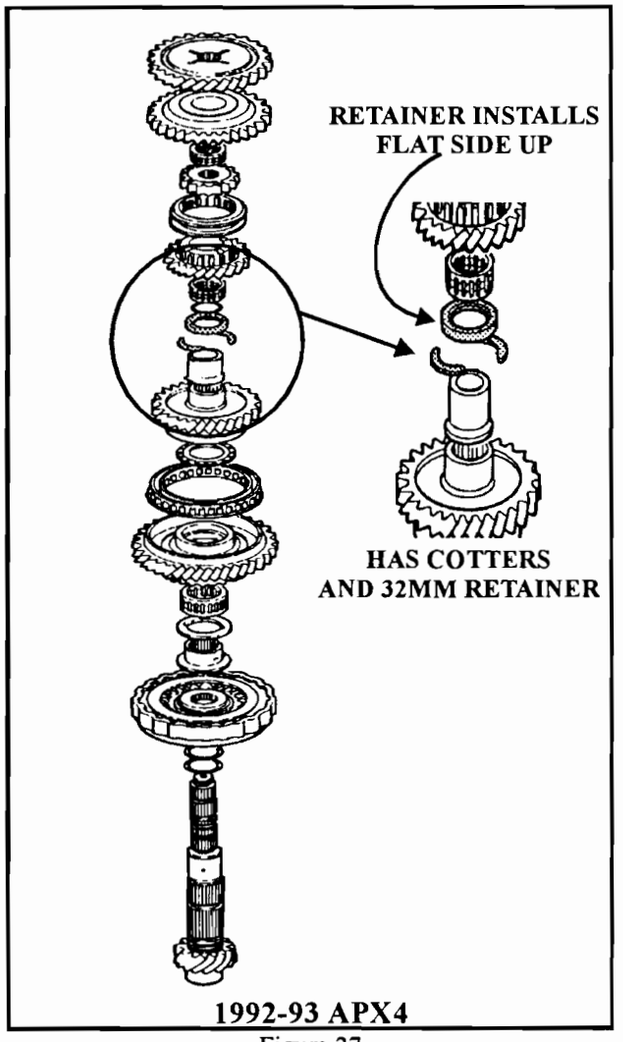


Figure 27

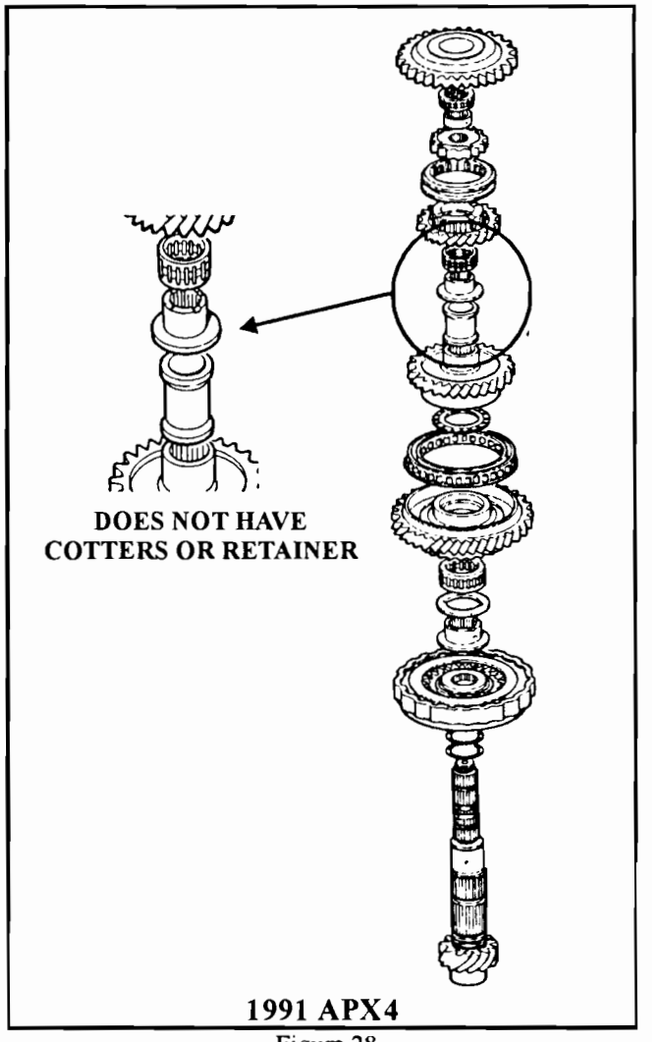


Figure 28

# SLIDE
# HONDA/ACURA
# VALVE BODY BORE PLUGS
## NUMEROUS PROBLEMS

COMPLAINT: The type of complaint will depend on which valve is affected by the incorrectly or mislocated bore plug.
For example, if it were a shift valve, you could have stacked or no upshift.
If it were a clutch pressure control valve you would have clutch slippage or if it were to be an orifice control valve you could have flared shifts.

CAUSE: A bore plug that is installed in the wrong bore or one that is installed backwards.

CORRECTION: If the valves have to be removed for cleaning, keep the bore plug with the valve it goes with and refer to figure 29 where the various types of bore plugs are illustrated and the correct direction in which they are to be installed in the valve bore is shown.

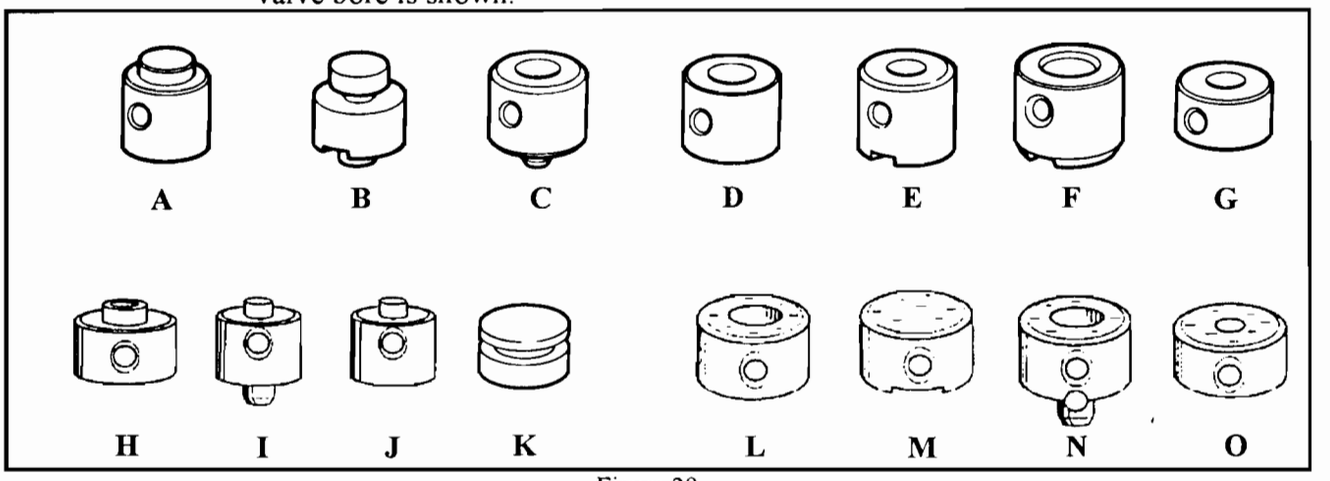



Figure 29

**A**-Plugs with 1 projected tip and 1 flat end are installed with the flat end toward the spring.
**B**-Plugs with a projected tip on each end are installed with the smaller tip toward the spring.
**C**-Plugs with 1 projected tip and 1 hollow end are installed with the tip toward the spring.
**D**-Plugs with 1 hollow end and 1 flat end are installed with the flat end towards the spring.
**E**-Plugs with notched ends are installed with the notch towards the spring.
**F**-Same as E
**G**- Plugs with flat ends and 1 large hole and 1 small hole are installed with the small hole towards the spring.
**H**-Plugs with 1 projected tip and 1 flat end are installed with the flat end towards the spring.
**I**-Same as B. The small projected tip acts as a spring guide.
**J**-Same as A.
**K**-Plugs with flat ends and a groove around the plug are installed with the groove closest to the spring.
**L**-Same as D
**M**-Plugs with 1 notched end and 1 flat end are installed with the notched end towards the spring.
**N**-Same as C
**O**-Plugs with 2 flat ends and a hole through the center can be installed either way.

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- Foreign & Domestic
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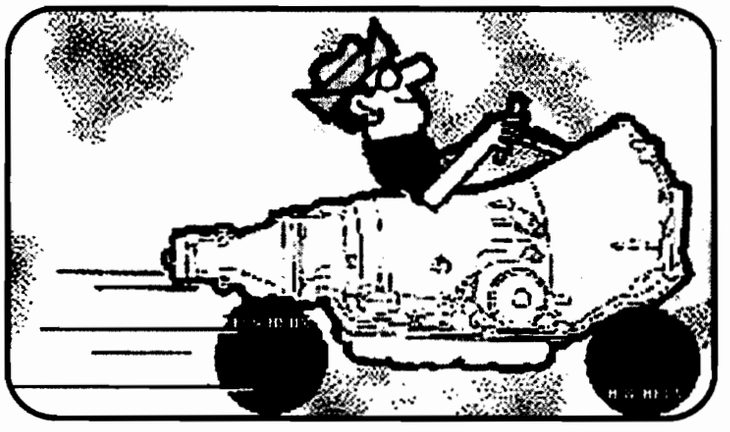


**Because You Want The Vehicle Out On Time**

# HONDA/ACURA SEAL ROTATION
## CHRONIC SEAL LEAK

COMPLAINT: Front seal or axle seal continues to leak even after multiple replacements.

CAUSE: Honda/Acura converter and axle seals can be direction sensitive and therefore attention must be paid to which way the shaft to be sealed will rotate.
The helix of the seal which are the angled lines on the lip of the seal indicate direction of rotation. (Refer to figure 30)
If a Honda Accord front seal was installed in an Acura Legend the front seal would leak because the Honda converter rotates in an opposite direction than the Acura converter.
Another cause of chronic seal front seal leakage is driving the seal into the converter housing to deep.

CORRECTION: Make certain the seal you are using has the correct helix for the direction of the shaft you are sealing. (Refer to figure 31)
Seals that are bidirectional will seal shafts rotating in either direction.
Axle seals can be bidirectional, Converter seals typically are not.
Install the front seal so that it is flush with the lip of the housing.

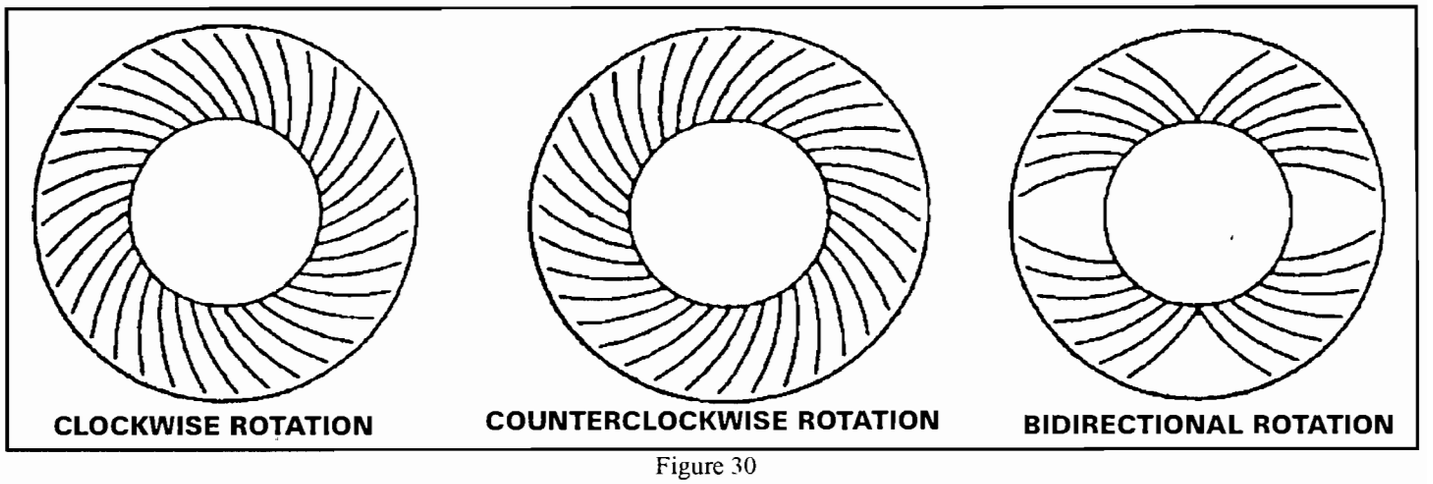



Figure 30

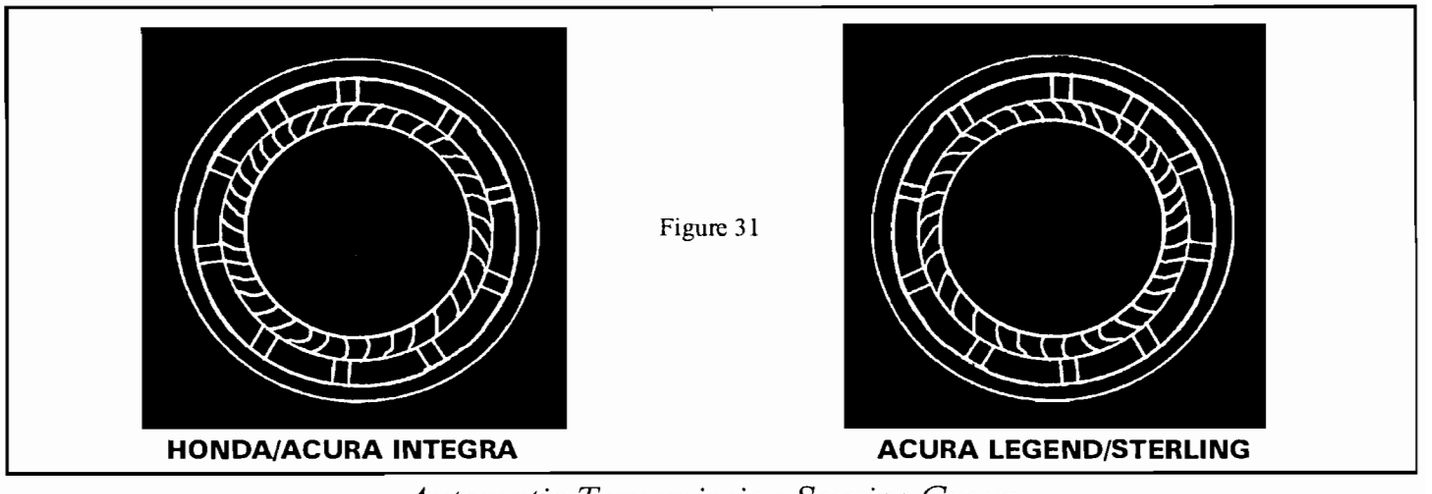



Figure 31

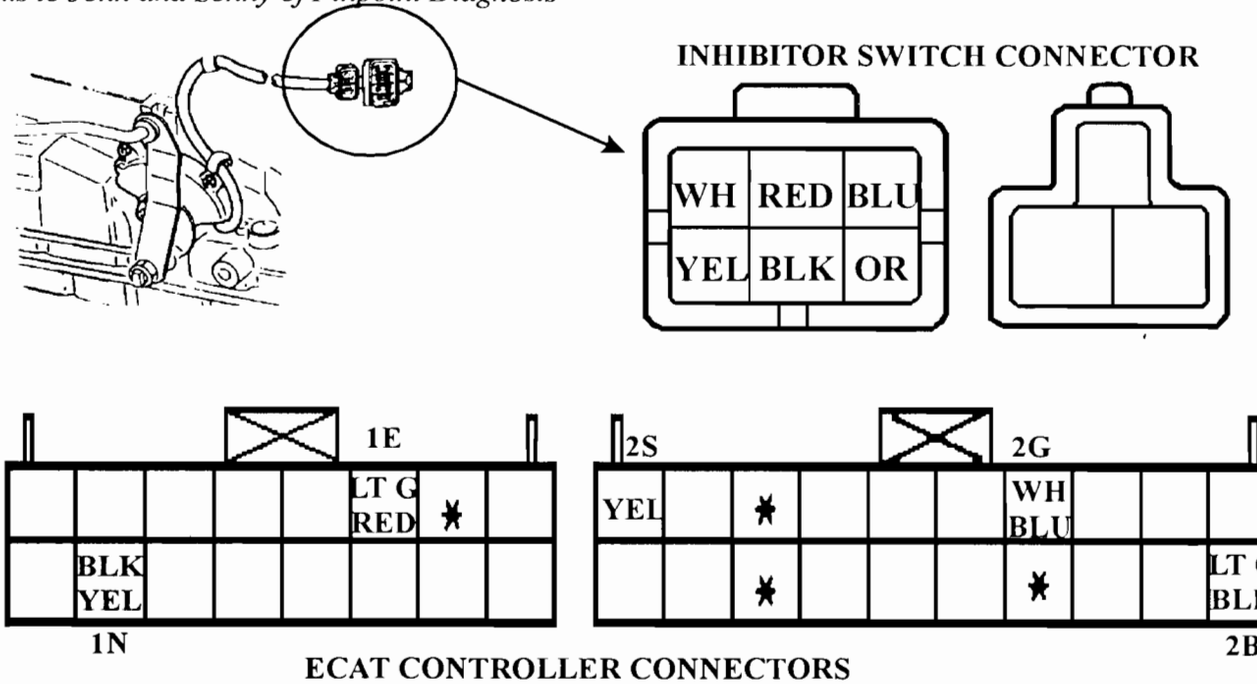
# MAZDA INHIBITOR SWITCH CORRECTION

CONDITION: MAZDA MPV's equipped with R4A-EL transmissions that require replacement of the inhibitor switch may experience a no 4th gear condition after installation of the NEW inhibitor switch.

CAUSE: Some NEW inhibitor switches were wired incorrectly at the factory. These wires were placed in the wrong position in the connector. It is the 6 pin connector that is wired incorrectly, the 3 pin connector is NOT affected. NOTE: NOT ALL SWITCHES WILL HAVE THE FOLLOWING WIRING COLORS. IF THE SWITCH DOES NOT HAVE THE WIRE COLORS SHOWN IN THE FIGURE BELOW, THIS BULLETIN DOES NOT APPLY.

CORRECTION: The wires that are mislocated will have to be removed from the connector and relocated to their correct location. Refer to the illustrations below which show the CORRECT wire location. Make certain the wire color and location in the inhibitor switch connector match the wire color and location in the ECAT control unit as it is shown in the chart below. The inhibitor switch part number is **BV1119444**.

*Thanks to John and Sonny of Pinpoint Diagnosis*




| INHIBITOR SWITCH | | ECAT CONTROLLER |
|---|---|---|
| WHITE | connects to | YELLOW |
| RED | connects to | LT. GREEN/BLACK |
| BLUE | connects to | LT. GREEN/RED |
| YELLOW | connects to | BLANK |
| BLACK | connects to | BLACK/YELLOW |
| ORANGE | connects to | WHITE/BLUE |

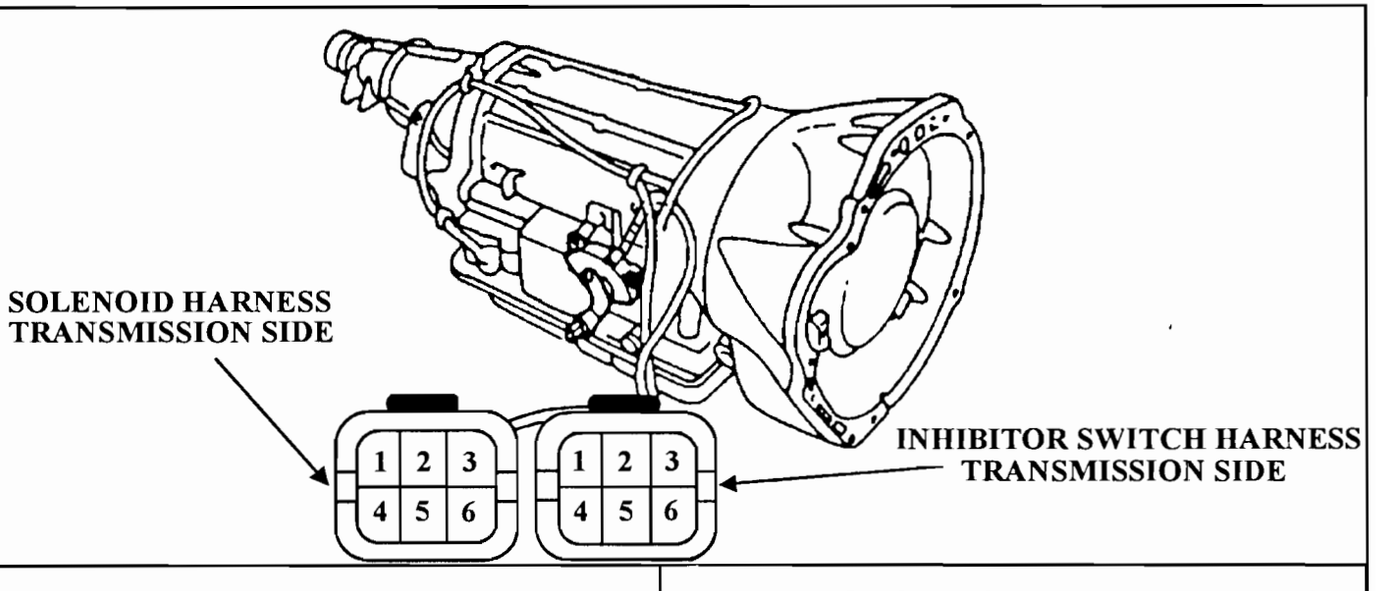
Figure 32

# MAZDA
## MPV R4A-EL
## 3RD GEAR STARTS

**COMPLAINT:** On early model MPV'S equipped with R4A-EL transmission's, after overhaul the vehicle exhibits 3rd gear starts in the Drive range and the "HOLD" light is continuously flashing.

**CAUSE:** The cause may be, the "Computer" side shift solenoid harness was connected to the "Inhibitor Switch," and the "Computer" side "Inhibitor switch" harness was connected to the shift solenoids. This will result in "NO" voltage sent to the shift solenoids, a 3rd gear start in the Drive range. This will also result in "Trouble Codes" being stored and causing the "HOLD" light to flash because the ECAT control unit now will see "Open Circuit's" at the solenoid wiring harness.

**CORRECTION:** Refer to Figure 33 to correctly identify "Inhibitor Switch" and "Solenoid" common wiring colors and switch the "Computer" side connectors to cure the problem.




| SOLENOID HARNESS COLORS | | | INHIBITOR SWITCH HARNESS COLORS | | |
|---|---|---|---|---|---|
| PIN | TRANSMISSION SIDE | ECAT CONTROLLER SIDE | PIN | TRANSMISSION SIDE | ECAT CONTROLLER SIDE |
| 1 | BLANK | BLANK | 1 | WHITE | YELLOW |
| 2 | WHITE/BLACK | WHITE/RED | 2 | RED | LT. GREEN/BLACK |
| 3 | WHITE/YELLOW | WHITE/YELLOW | 3 | BLUE | LT. GREEN/RED |
| 4 | GREEN | WHITE/BLACK | 4 | YELLOW | BLANK |
| 5 | WHITE/RED | WHITE/GREEN | 5 | BLACK | BLACK/YELLOW |
| 6 | WHITE/GREEN | WHITE | 6 | ORANGE | WHITE/BLUE |

Figure 33

# MAZDA
## G4A-EL
## STACKED SHIFT'S

**COMPLAINT:** Vehicles equipped with G4A-EL transmissions may exhibit early or "Stacked Shift's" with Converter Clutch apply by 20 mph., ***after overhaul,*** without storing any trouble codes.

**CAUSE:** The cause may be, a mismatched 1993 Reverse and Forward drum was installed into as 1987-92 vehicle. REASON: 1987-92 Reverse and Forward drums have 12 "Projections." 1993 Reverse and Forward drums have 16 "Projections." These "Projections" are picked up by the "Pulse Generator" converting drum or turbine speed into an A.C. current or frequency that is sent to the ECAT computer. When a 16 "Projection" drum is installed into an 1987-1992 vehicle, drum or turbine speed will automatically be faster and may change shift strategy. (See Figure 34)

**CORRECTION:** Refer to Figure 35 to identify model year and install the proper drum for your application.

**REVERSE AND FORWARD DRUM IDENTIFICATION**

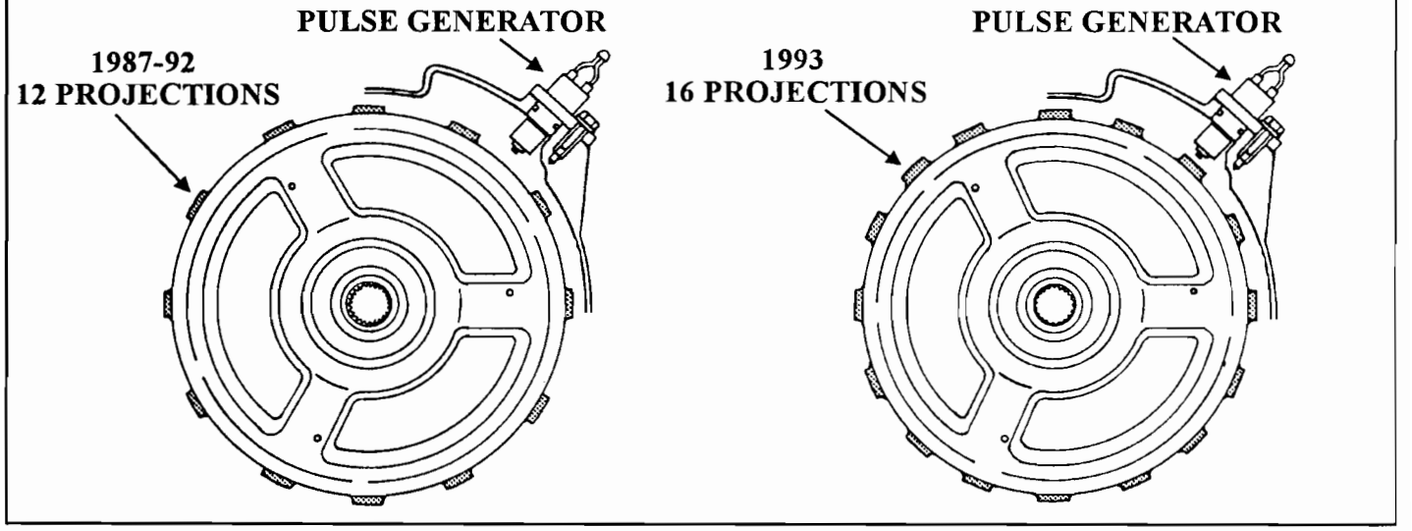



Figure 34

**MODEL YEAR IDENTIFICATION**

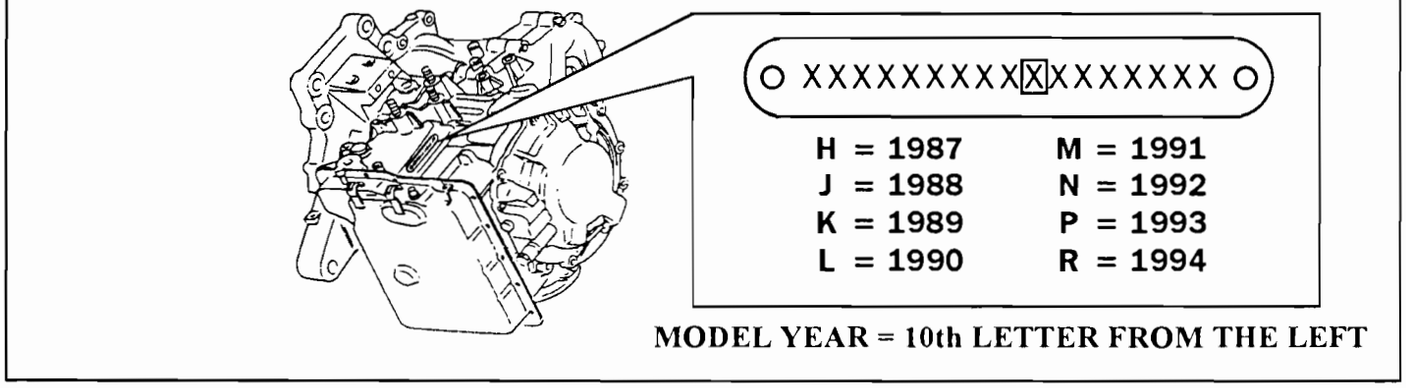



Figure 35

# MAZDA

## G4A-EL, F4A-EL, R4A-EL

## DIAGNOSTIC CONNECTOR LOCATIONS AND CODE RETRIEVAL

**MAZDA: MX6/626 G4A-EL**

1986-87: The O.D. Cancel light will begin to flash if transmission related trouble codes are being stored.

LOCATION: The 6 pin diagnostic connector is located 6-10 inches away from the ECAT main computer connector which is located at the left of the steering column. (See Location 1 in Figure 36)

PROCEDURE: Codes may be retrieved by using the ECAT tester. The codes will read in numerical order. To advance to the next code, cycle the O.D. Cancel button twice. (See Code Chart 1 in Figure 37)

1988-89:
1990-92 TURBO: The HOLD light will flash if transmission related trouble codes are being stored.

LOCATION: The BLUE diagnostic connectors are located 6-10 inches from the ECAT main computer connector which is located at the left of the steering column NOTE: The diagnostic connectors may be taped to the main computer harness and may be difficult to find. (See Location 1 in Figure36)

PROCEDURE: Codes may be retrieved simply by inserting a jumper wire into the BLUE single pin connector, located next to the BLUE six pin connector. Ground the jumper wire and turn on the ignition. The codes will begin to flash over the HOLD light and will read in numerical order. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= CODE 62. There will be a 4 second pause between codes, if any others exist. The codes will repeat themselves until the jumper wire is removed or the ignition is turned off. (See Code Chart 2 in Figure 38)

1990-92: The HOLD light will flash if transmission related trouble codes are being stored.

LOCATION: The GREEN diagnositic connectors are located in the engine compartment near the windshield wiper motor and the driver side strut tower. (See Location 2 in Figure 36)

PROCEDURE: Codes may be retrieved simply by inserting a jumper wire into the GREEN single pin connector, located next to the GREEN 6 pin connector. Ground the jumper wire and turn on the ignition. Because the Engine and Transmission Computer are all in one, the codes will begin to flash over the M.I.L.(Malfunction Indicator Lamp) another word for the Check Engine Light. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= Code 62. There will be a 4 second pause between codes if any others exist. The codes will repeat themselves until the jumper wire is disconnected or the ignition is turned off. NOTE: The Check Engine Light will give both transmission and engine codes. (See Code Chart 3 in Figure 39)

Continued next Page

**MAZDA: 323 & PROTEGE F4A-EL**

1990-91: The HOLD light will flash if transmission related trouble codes are being stored.
LOCATION: The multiple pin diagnostic connector is located behind the battery below the windshield wiper motor. (See Location 3 in Figure 36)
PROCEDURE: Codes may be retrieved simply by inserting a jumper wire between the TAT and GND terminals. The codes will begin to flash over the HOLD light and will read in numerical order when the ignition is turned on. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= Code 62. The codes will repeat themselves until the jumper wire is disconnected or the ignition is turned off. (See Code Chart 2 in Figure 38)

1992-93: The HOLD light will flash if transmission related trouble codes are being stored.
LOCATION: The multiple pin diagnostic connector is located behind the battery below the windshield wiper motor. (See Location 3 in Figure 36)
PROCEDURE: Codes may be retrieved by inserting a jumper wire between the TEN and GND terminals. Because the engine and transmission Computer are all in one, the codes will begin to flash over the M.I.L. (Malfunction Indicator Lamp) another word for Check Engine Light. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= Code 62. There will be a 4 second pause between codes if any others exist. The codes will repeat themselves until the jumper wire is disconnected or the ignition is turned off. NOTE: The Check Engine Light will give us both transmission and engine codes. (See Code Chart 4 in Figure 40)

**MAZDA: MPV R4A-EL**

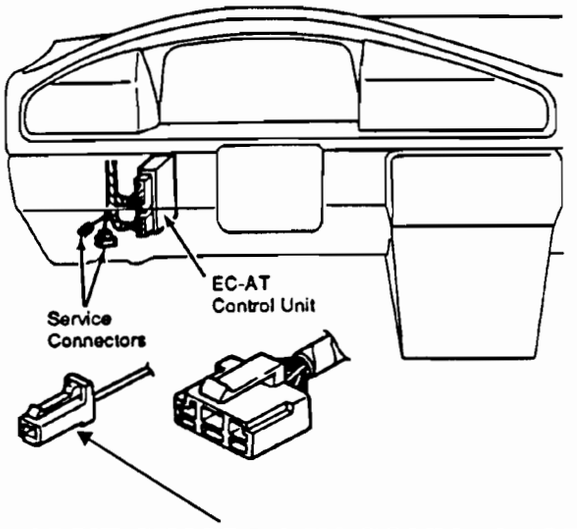
ALL MODELS: The HOLD light will flash if transmission related codes are being stored.
LOCATION: The BLUE diagnostic connectors are located 6-10 inches from the ECAT main computer connector which is located at the left of the steering column. (See Location 1 in Figure 36)
PROCEDURE: Codes may be retrieved simply by inserting a jumper wire into the BLUE single pin connector, located next to the BLUE 6 pin connector. Ground the jumper wire and turn on the ignition. The codes will begin to flash over the HOLD light and will read in numerical order. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= Code 62. There will be a 4 second pause between codes if any others exist. The codes will repeat themselves until the jumper wire is disconnected or the ignition is turned off. (See Code Chart 5 in Figure 41)

**MAZDA: 929 R4A-EL**

1992 AND UP: The HOLD light will flash if transmission related codes are being stored.
LOCATION: The black multiple pin datalink connector is located by drivers side fender well.
PROCEDURE: Codes may be retrieved simply by inserting a jumper wire between the TAT and GND terminals. The codes will begin to flash over the HOLD light and will read in numerical order when the ignition is turned on. The first digit of the code will flash longer than the second digit. EXAMPLE: 6 long flashes a 1.5 second pause followed by 2 short flashes= Code 62 (See Code Chart 5 in Figure 41)

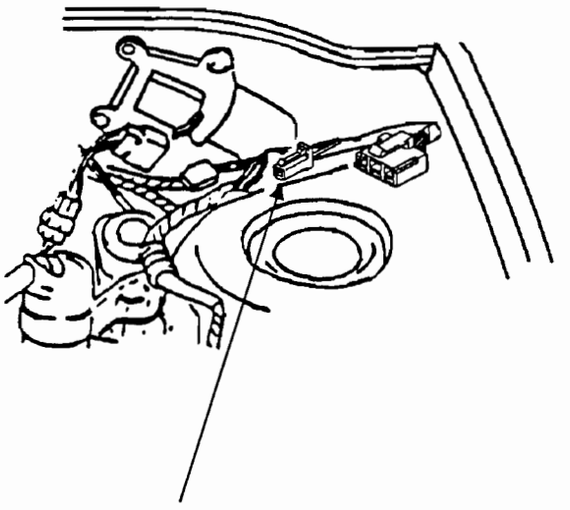
## MAZDA DIAGNOSTIC CONNECTOR LOCATIONS

### LOCATION 1



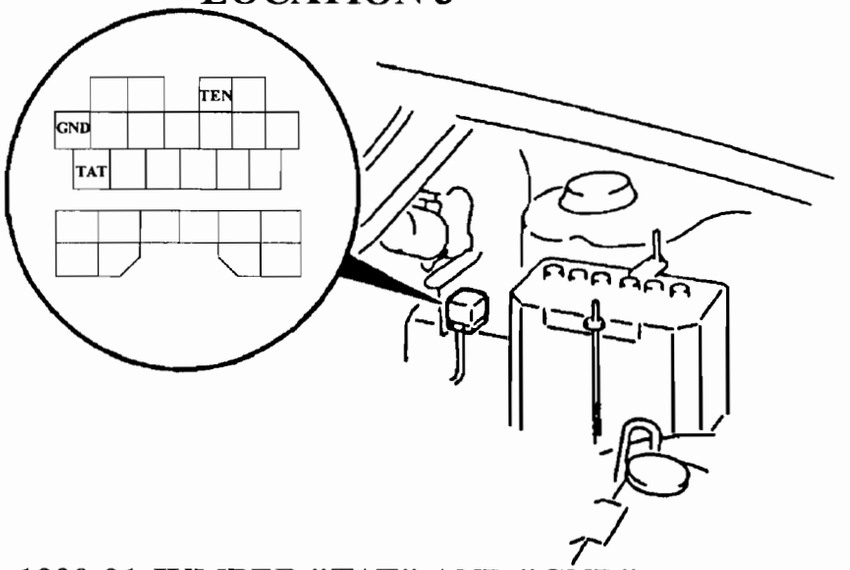

BLUE SINGLE PIN CONNECTOR

### LOCATION 2



GREEN SINGLE PIN CONNECTOR

### LOCATION 3




1990-91 JUMPER "TAT" AND "GND"

1992-93 JUMPER "TEN" AND "GND"

Figure 36

# MAZDA DIAGNOSTIC CHARTS

## CODE CHART 1

| ECAT TESTER CODE # | LOCATION OF MALFUNCTION |
|---|---|
| 06 | THROTTLE POSITION SENSOR |
| 11 | PULSE GENERATOR |
| 13 | VEHICLE SPEED SENSOR |
| 16 | 1-2 SOLENOID |
| 17 | 2-3 SOLENOID |
| 18 | 3-4 SOLENOID |
| 19 | LOCKUP SOLENOID |

Figure 37

## CODE CHART 2

| CODE NO. | LOCATION OF MALFUNCTION | HOLD INDICATOR LAMP FLASH CYCLE |
|---|---|---|
| 06 | VEHICLE SPEED SENSOR |   |
| 12 | THROTTLE SENSOR |  |
| 55 | PULSE GENERATOR |  |
| 57 | SHIFT SIGNAL * |  |
| 60 | 1-2 SHIFT SOLENOID |  |
| 61 | 2-3 SHIFT SOLENOID |  |
| 62 | 3-4 SHIFT SOLENOID |  |
| 63 | LOCKUP SOLENOID |  |

*** - NOT USED ON ALL MODELS**

Figure 38

# MAZDA DIAGNOSTIC CHARTS CONTINUED

## CODE CHART 3

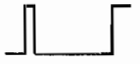
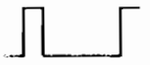
| CODE NO. | LOCATION OF MALFUNCTION | CHECK ENGINE LIGHT |
|---|---|---|
| 1 | IGNITION PULSE |  |
| 8 | AIRFLOW METER |  |
| 9 | WATER THERMOSENSOR |  |
| 10 | INTAKE AIR THERMOSENSOR |  |
| 12 | THROTTLE SENSOR |  |
| 14 | ATMOSPHERIC PRESSURE SENSOR (IN ECU) |  |
| 15 | OXYGEN SENSOR |  |
| 16 | EGR POSITION SENSOR |  |
| 17 | FEEDBACK SYSTEM |  |
| 25 | SOLENOID VALVE (PRESSURE REGULATOR) |  |
| 26 | SOLENOID VALVE (PURGE CONTROL) |  |
| 28 | SOLENOID VALVE (EGR) |  |
| 34 | ICS VALVE |  |
| 55 | PULSE GENERATOR |  |
| 60 | 1-2 SHIFT SOLENOID |  |
| 61 | 2-3 SHIFT SOLENOID |  |
| 62 | 3-4 SHIFT SOLENOID |  |
| 63 | LOCKUP SOLENOID |  |

Figure 39

# MAZDA DIAGNOSTIC CHARTS CONTINUED

## CODE CHART 4

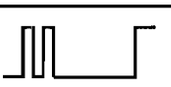
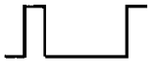
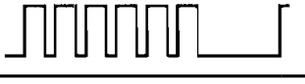
| CODE NO. | LOCATION OF MALFUNCTION | CHECK ENGINE LIGHT |
|---|---|---|
| 2 | RPM SIGNAL |  |
| 6 | VEHICLE SPEED SENSOR |  |
| 8 | AIRFLOW METER |  |
| 9 | WATER THERMOSENSOR |  |
| 10 | INTAKE AIR THERMOSENSOR |  |
| 12 | THROTTLE SENSOR |  |
| 14 | ATMOSPHERIC PRESSURE SENSOR (IN ECU) |  |
| 15 | OXYGEN SENSOR (INACTIVATION) |  |
| 17 | OXYGEN SENSOR (INVERSION) |  |
| 25 | SOLENOID VALVE (PRESSURE REGULATOR) |  |
| 26 | SOLENOID VALVE (PURGE CONTROL) |  |
| 34 | ICS VALVE |  |
| 55 | PULSE GENERATOR |  |
| 60 | 1-2 SHIFT SOLENOID |  |
| 61 | 2-3 SHIFT SOLENOID |  |
| 62 | 3-4 SHIFT SOLENOID |  |
| 63 | LOCKUP SOLENOID |  |

Figure 40

# MAZDA DIAGNOSTIC CHARTS CONTINUED

## CODE CHART 5

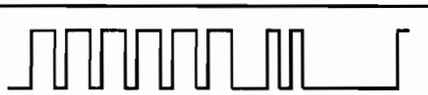
| CODE NO. | LOCATION OF MALFUNCTION | HOLD INDICATOR LAMP FLASH CYCLE |
|---|---|---|
| 1 | ENGINE RPM SENSOR |  |
| 6 | SPEED SENSOR NO. 1 |  |
| 7 | SPEED SENSOR NO. 2 (IN SPEEDOMETER) |  |
| 12 | THROTTLE SENSOR |  |
| 55 | VEHICLE SPEED PULSE GENERATOR (929) |  |
| 56 | ATF THERMOSENSOR |  |
| 57 | REDUCED TORQUE SIGNAL (929) |  |
| 60 | SHIFT SOLENOID A |  |
| 61 | SHIFT SOLENOID B |  |
| 62 | OVERRUN CLUTCH SOLENOID |  |
| 63 | LOCKUP SOLENOID |  |
| 64 | LINE PRESSURE SOLENOID |  |
| 65 | LOCKUP CONTROL SOLENOID (929) |  |

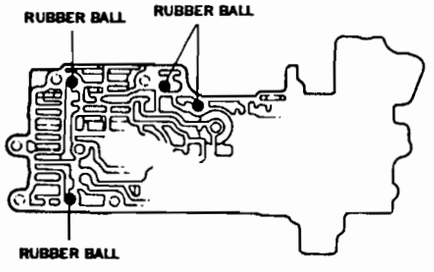
Figure 41

# MAZDA
## F4AEL
## CHECK BALL LOCATIONS

Factory manuals have revealed that 1990 - 1992 Mazda 323 & Protege, equipped with F4A-EL transaxles, have different check ball locations in the premain & main valve bodies. ATSG has been unsuccessful to verify this information. The valve bodies that ATSG researched all had the same check ball locations as 1993 in figure 43. However ATSG is supplying the information in case one happens to come across the need for it.

1990

**MAIN VALVE BODY**




**PREMAIN VALVE BODY**

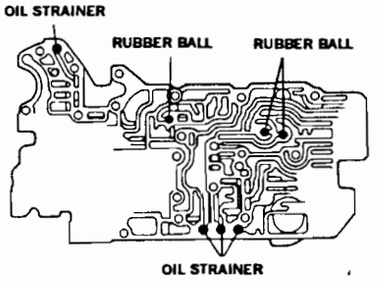
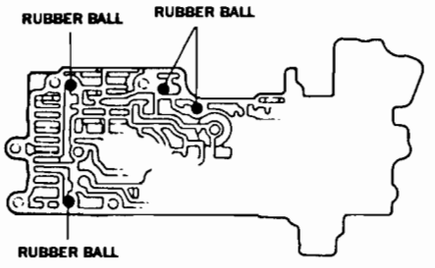


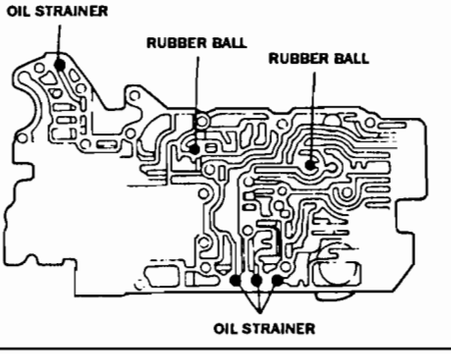

Figure 42

**1991 & 1992**

**MAIN VALVE BODY**

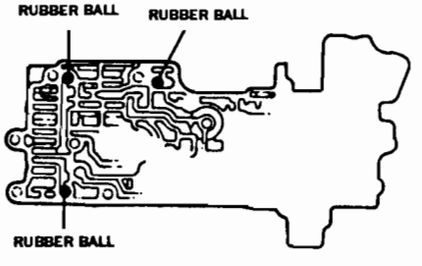



**PREMAIN VALVE BODY**




**1993**

**MAIN VALVE BODY**




**PREMAIN VALVE BODY**

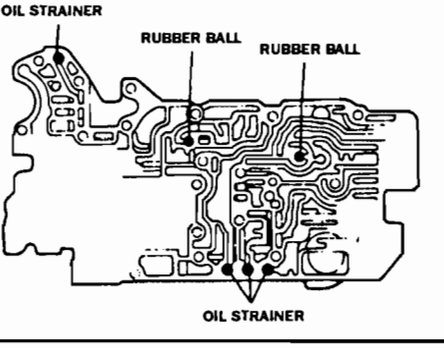



Figure 43

# MAZDA

## G4A-EL

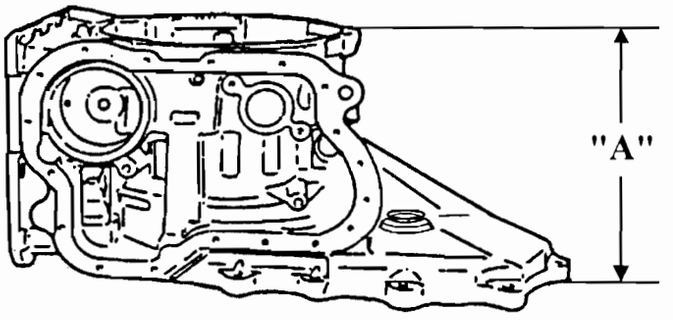
## NO REVERSE OR DRIVES IN NEUTRAL

**COMPLAINT:** Vehicles equipped with G4A-EL transmissions may exhibit a no Reverse, Drives in Neutral, or a sensation of two ranges being applied at the same time or "Binding Up" on engagements or upshift's after replacing the "Valve Body" or rear "Case" half.

**CAUSE:** The cause may be a mismatched "Manual Valve" to" Case."

**CORRECTION:** Refer to Figure 44 to correctly identify and match 2.2 Turbo, 3.0L, and 2.2 Non-Turbo "Manual Valve" and rear "Case" dimensions. Install the proper "Manual Valve" for your application.

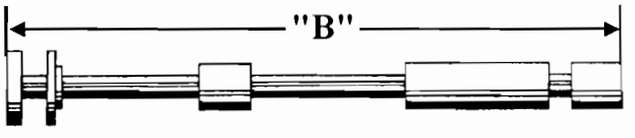
### REAR CASE IDENTIFICATION



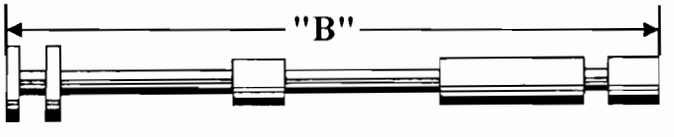

**DIMENSION "A"= 8 INCHES ON 2.2 "NON-TURBO" MODELS**
**DIMENSION "A"= 8.250 INCHES ON 2.2 "TURBO" AND 3.0L MODELS**
**DIMENSION "A"=THE DISTANCE BETWEEN THE PUMP AND CASE MATING SURFACES**

### MANUAL VALVE IDENTIFICATION

**2.2L "NON TURBO"**




**2.2L " TURBO"&3.0L**




**DIMENSION "B"= 5.100 INCHES ON 2.2 "NON TURBO" MODELS**
**DIMENSION "B"= 5.350 INCHES ON 2.2 "TURBO" AND 3.0L MODELS**

Figure 44

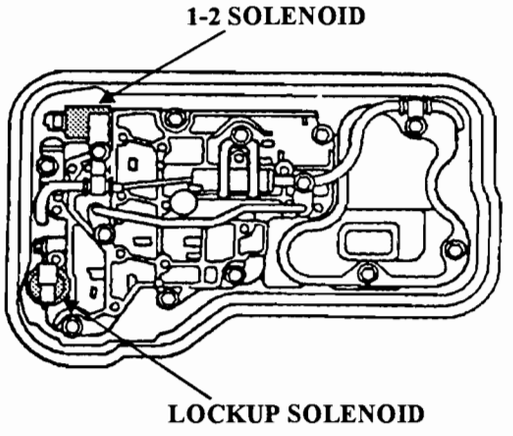
# MAZDA
## F4A-EL/F4EAT
## UPSHIFTS 1-3 IN DRIVE

**COMPLAINT:** Vehicles equipped with F4A-EL or F4EAT exhibit, what seems like, a 1-3 upshift in the "Overdrive" or "Drive ranges after overhaul.

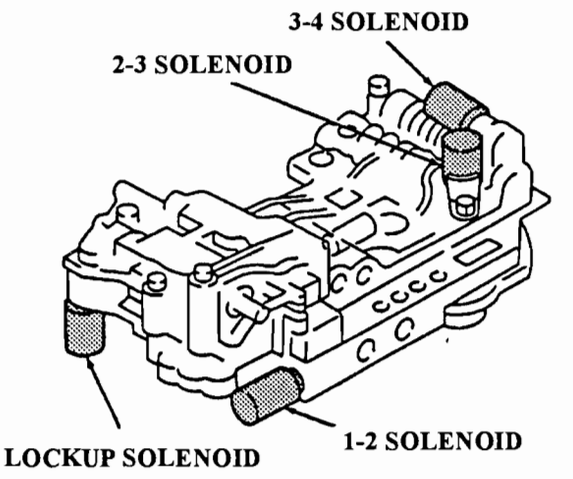
**CAUSE:** The cause may be, the 1-2 shift solenoid wire was placed into the Lockup solenoid and the Lockup solenoid wire was placed into the 1-2 shift solenoid. When the solenoids are connected backwards it produces a 1-Lockup-3 upshift.

**CORRECTION:** Refer to the color code and solenoid application chart in Figure 45 to correctly identify and connect each solenoid.

**VALVE BODY INSTALLED**




**VALVE BODY REMOVED**



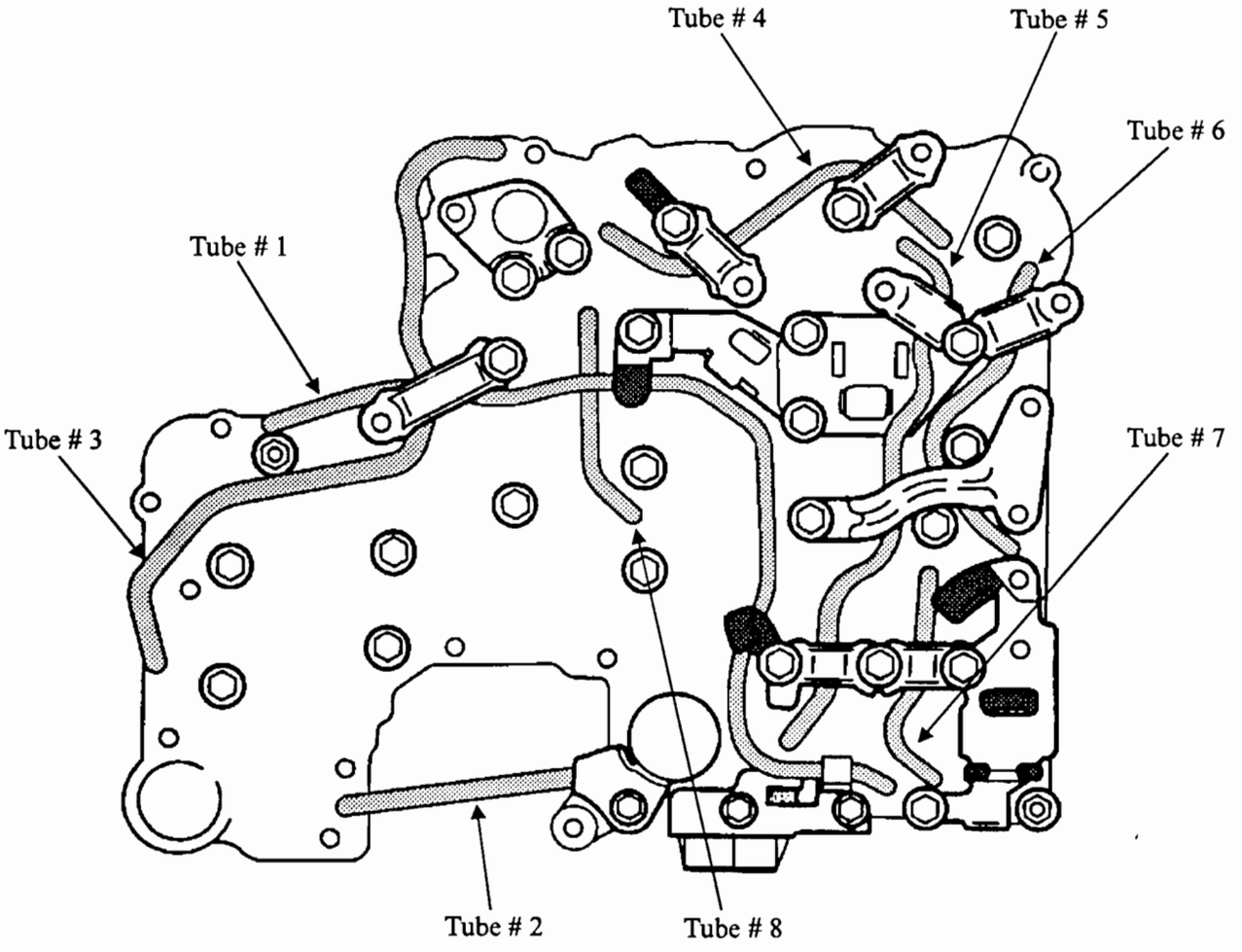

| SOLENOID | INTERNAL WIRE COLOR |
|---|---|
| 1-2 | GREEN |
| 2-3 | BLUE |
| 3-4 | YELLOW |
| LOCKUP | WHITE |

Figure 45

*SLIDE*

# MAZDA 929 R4A-EL

## TUBE LOCATION AND FUNCTION




Tube # 1 - Boost to Modifier Accumulator Valve.

Tube # 2 - Lock up control solenoid oil to lock up Modifier valve.

Tube # 3 - Reverse Input to 3/4-Reverse Accumulator (Back Pressure).

Tube # 4 - Fourth gear oil after the ball.

Tube # 5 - Line to the 2-3 Accumulator (Shoulder Pressure).

Tube # 6 - Forward clutch oil to the N-D Accumulator.

Tube # 7 - To Shuttle shift valve "S" back land.

Tube # 8 - 3-2 timing valve to 4-2 Sequence valve.

Figure 46

# MAZDA 929 R4A-EL
## TUBE LOCATION AND FUNCTION

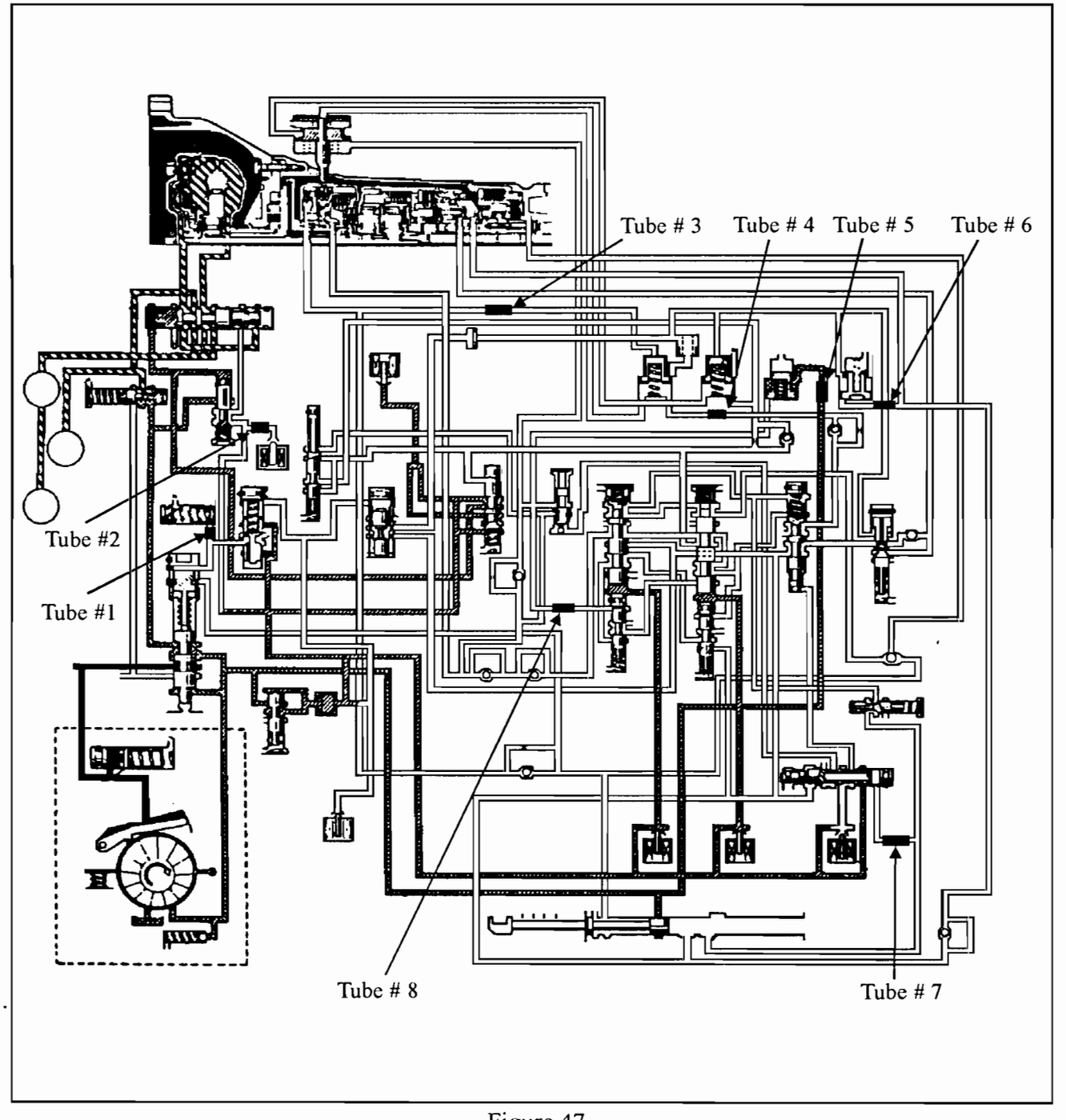



Figure 47

# NISSAN RE4RO1A

## THE PRESSURE REGULATOR VALVE CAUSES NO PRESSURE RISE

**Complaint:** After overhaul an **RE4RO1A** automatic transmission exhibits a complaint of low line pressure with little or no pressure rise. New solenoids are installed, the electronics are checked and no problems. The complaint of no line pressure rise still exists.

**Cause:** One cause may be the pressure regulator valve in the valve body installed backward. With the pressure regulator valve installed incorrectly, unregulated line pressure is sent to the pump slide and keeps the pump slide in a low output position. When this occurs line pressure rise is not possible, although a slight rise may be noticed due to increased pump rpm when engine rpm is increased.

**Correction:** Insert the pressure regulator valve into the bore with the smallest land going in first. This will allow proper regulation of the pressure regulator valve which will provide the needed line rise. Figures 48 through 56 provide diagrams of different pressure regulator valve line-ups for different models that you may encounter when working on one of these units. It is best to keep all pressure regulator line-ups as a set. Mismatching pressure regulator line-ups, may also result in low line pressure.

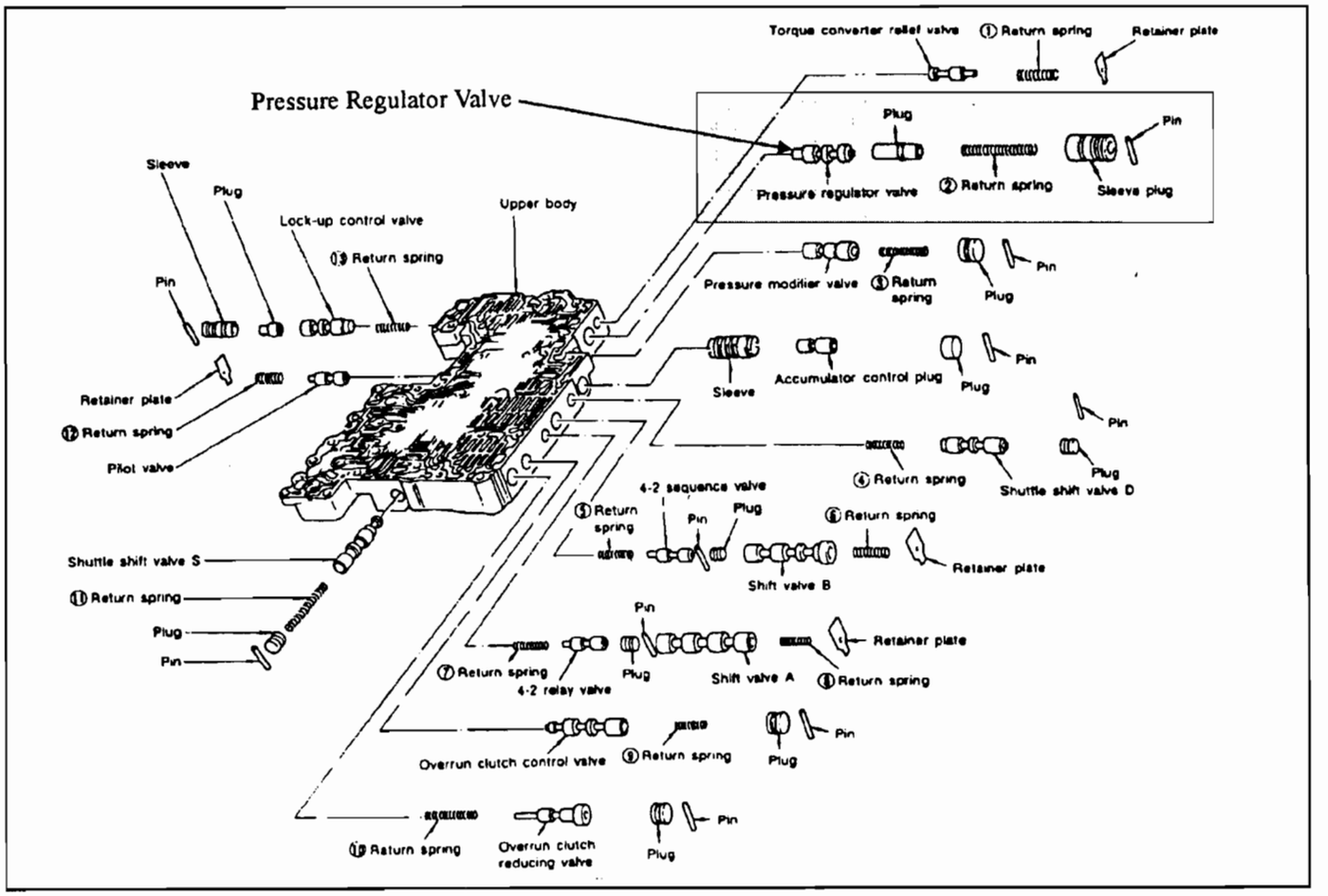



Figure 48

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.087

**Land Diameter and Length**

**1.** Dia. .318" Length .294"
**2.** Dia. .589" Length .433"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .220"

Land "1" goes into valve body first. Non machined flat around diameter of land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.201" |
| Inside Dia. | .661" |
| Outside Dia. | .787" |

I.D. Recess with one ring.

**Spring**

| | |
|---|---|
| Free Length | 1.640" |
| Inside Dia. | .408" |
| Outside Dia. | .519" |
| Wire Dia. | .054" |

No. of Coils 12

**Boost Plug**
Overall Length of Plug 1.640"

**Land Diameter and Length**

**5.** Dia. .660" Length .118"
**6.** Dia. .606" Length .376"

Spring seat goes over the stem. Two I.D. rings one next to land "5" in back of the machined area, one in front of the machined area on the stem shown in Figure 49 below.

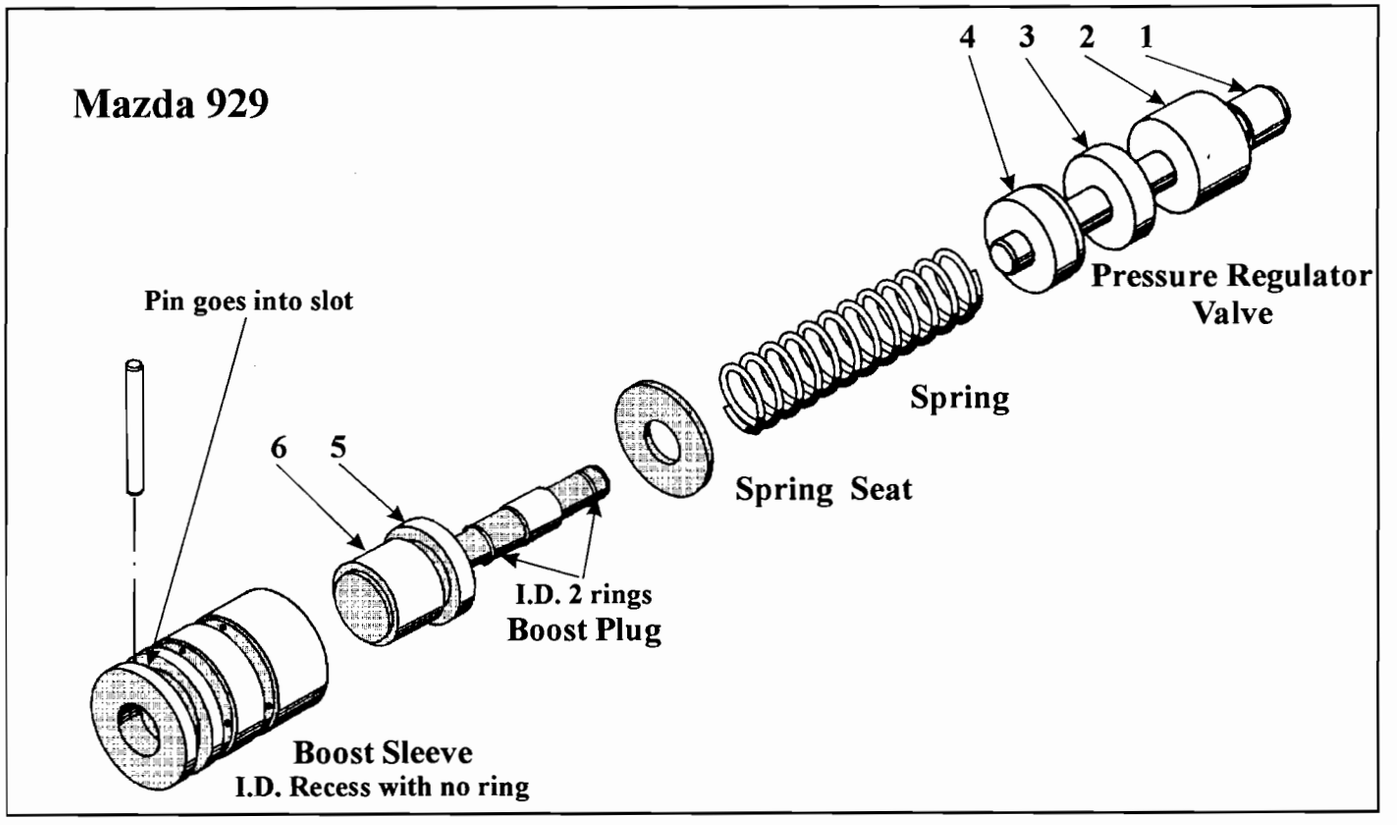



Figure 49

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land Diameter and Length**

**1.** Dia. .318" Length .288"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .220"

Land "1" goes into valve body first. Non machined flat around diameter on land "4"

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.201" |
| Inside Dia. | .685" |
| Outside Dia. | .787" |

I.D. Recess with one ring

**Spring**

| | |
|---|---|
| Free Length | 1.197" |
| Inside Dia. | .420" |
| Outside Dia. | .548" |
| Wire Dia. | .064" |
| No. of Coils | 7 |

**Boost Plug**
Overall Length of Plug 1.548"

**Land Diameter and Length**

**5.** Dia. .684" Length .120"
**6.** Dia. .648" Length .374"

Spring seat goes over the stem. Two I.D. Rings both in back of the machined area on the stem closest to land "5" shown in Figure 50 below.

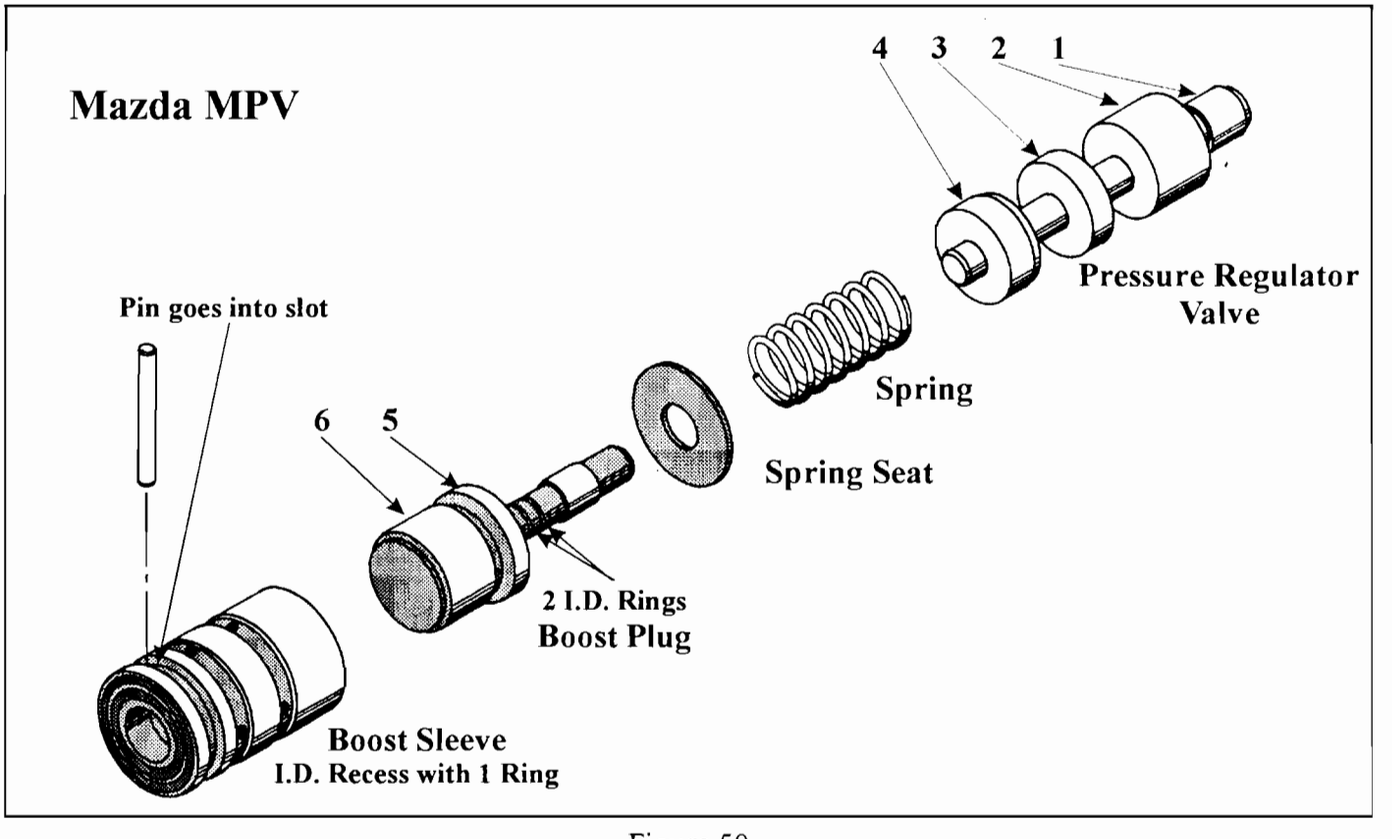



Figure 50

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land diameter and Length**

**1.** Dia. .318" Length .288"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .280"

Land "1" goes into valve body first. Flats .070" wide on both sides of valve on "1" and "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.219" |
| Inside Dia. | .598" |
| Outside Dia. | .787" |

I.D. Recess with no ring

**Spring**

| | |
|---|---|
| Free Length | 2.330" |
| Inside Dia. | .345" |
| Outside Dia. | .247" |
| Wire Dia. | .049" |
| No. of Coils | 21 |

**Boost Plug**
Overall Length of Plug 1.548"

**Land Diameter and Length**

**5.** Dia. .597" Length .117"
**6.** Dia. .519" Length .397"

Inside Depth of Valve 1.477"
Valve opening goes into boost sleeve.

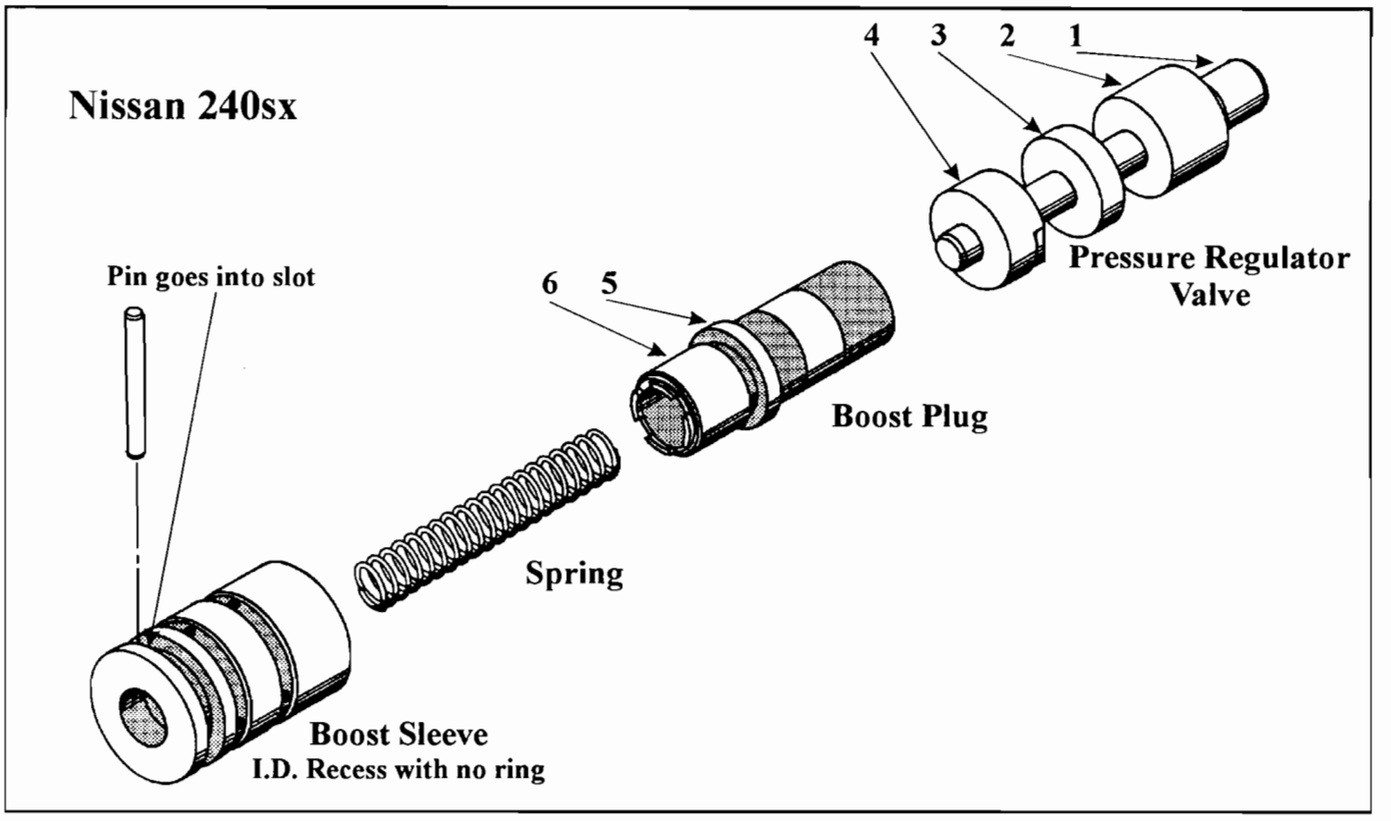



Figure 51

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land Diameter and Length**

**1.** Dia. .318" Length .288"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .280"

Land "1" goes into valve body first. Non machined flat around diameter of land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.201" |
| Inside Dia. | .663" |
| Outside Dia. | .787" |

I.D. Recess with no ring.

**Spring**

| | |
|---|---|
| Free Length | 1.650" |
| Inside Dia. | .435" |
| Outside Dia. | .545" |
| Wire Dia. | .055" |

No. of Coils 10.

**Boost Plug**
Overall Length of Plug 1.575"

**Land Diameter and Length**

**5.** Dia. .662" Length .120"
**6.** Dia. .607" Length .374"

Spring seat goes over the stem. Three I.D. rings next to land "5" in back of the machined area on the stem shown in Figure 52 below.

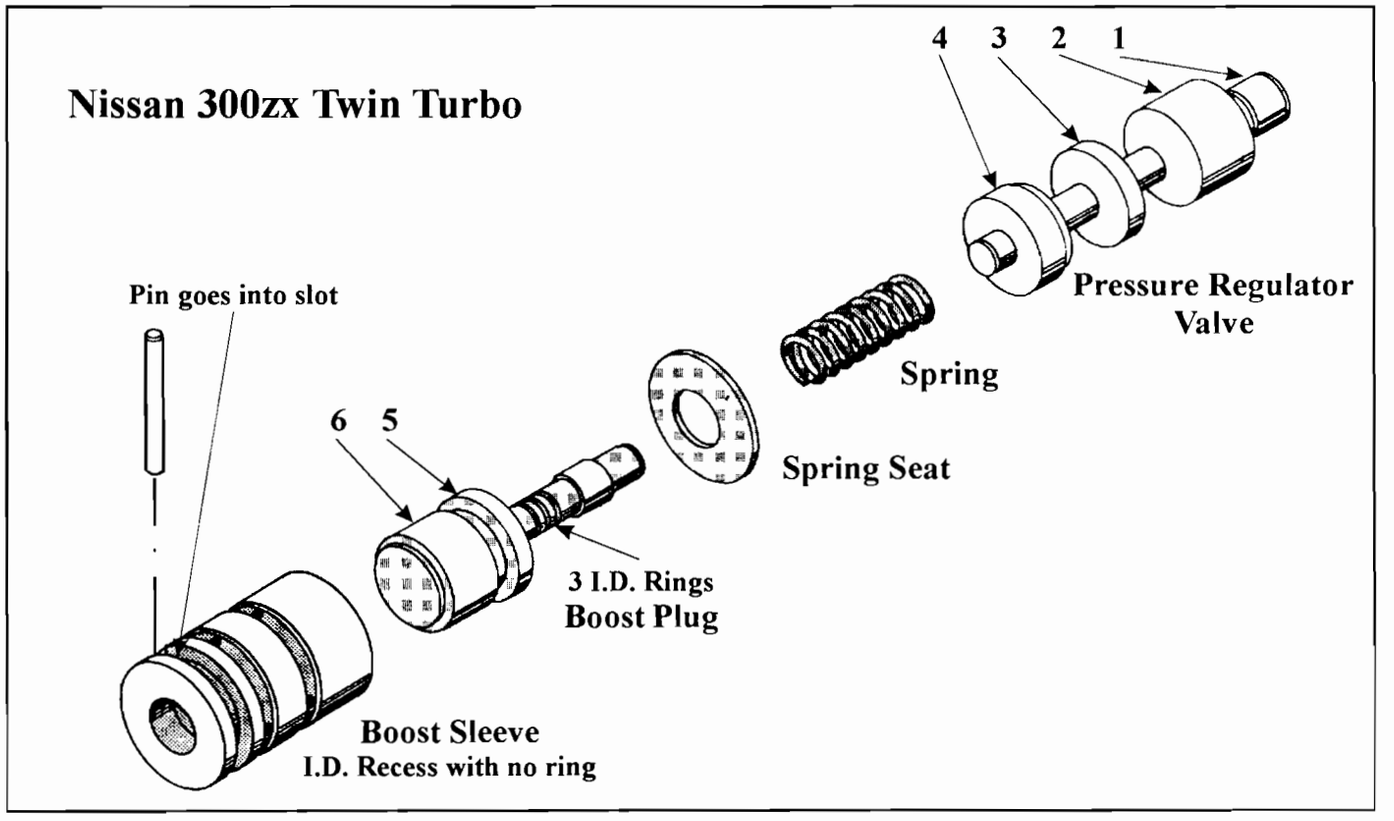



Figure 52

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.188"

**Land Diameter and Length**

**1.** Dia. .318" Length .355"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .280"

Land "1" goes into valve body first. Non machined flat around diameter of land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.240" |
| Inside Dia. | .655" |
| Outside Dia. | .787" |

I.D. Recess with no ring.

**Spring**

| | |
|---|---|
| Free Length | 1.650" |
| Inside Dia. | .396" |
| Outside Dia. | .510" |
| Wire Dia. | .057" |

No. of Coils 10

**Boost Plug**
Overall Length of Plug 1.575"

**Land Diameter and Length**

**5.** Dia. .652" Length .118"
**6.** Dia. .600" Length .476"

Spring seat goes over the stem. One I.D. ring next to land "5" in back of the machined area on the stem shown in Figure 53 below.

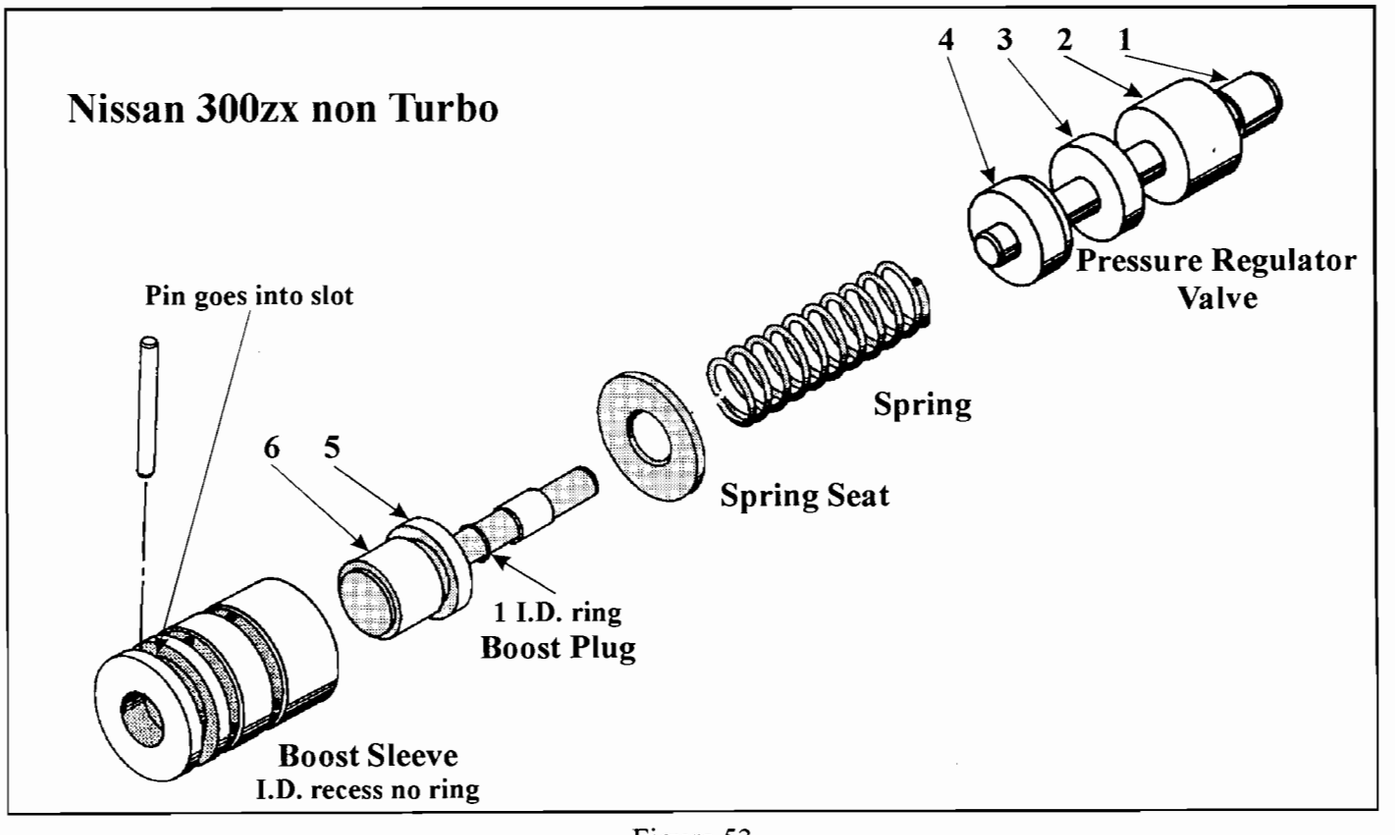
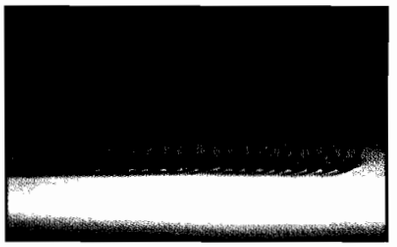



Figure 53

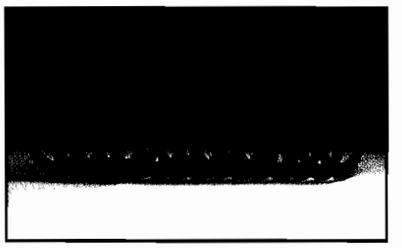
# PowerPacks® by Alto®

## Manufacturer of Automatic Transmission Clutches



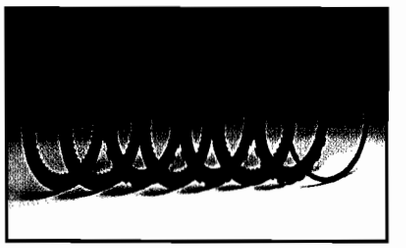
### 4L60-E/TH700-R4 3/4

Eliminates 3/4 clutch distress & burn up. Contains custom made snap ring. Enhances performance & durability.



### 4T60/TH440-T4 2nd

Eliminates 2nd clutch distress & burn up. Allows for additional steels & frictions to be installed.

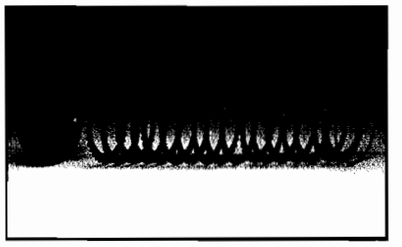


### TH400 INTERMEDIATE

Eliminates intermediate clutch distress & burn up. Use in vehicles that receive added stress & abuse like 4x4's & police cars.

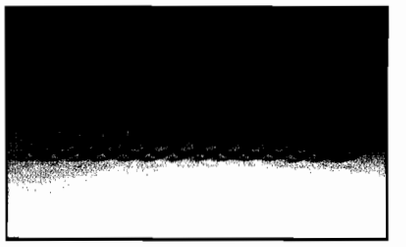
### FORD AOD DIRECT

Eliminates direct clutch distress & burn up. Use in all heavy duty applications, commercial vehicles & trucks.



### FORD AOD-E DIRECT

Eliminates direct clutch distress & burn up. Use in OEM "grob" drum. Designed to give enhanced durability.

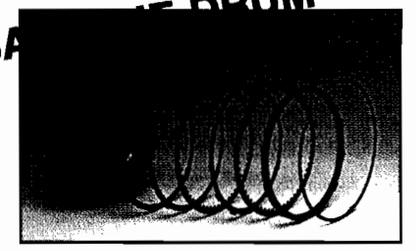


### A4LD

Eliminate distress & burn up in the reverse/high clutch.

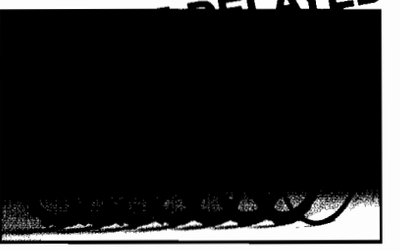
### 4T60E/TH440-T4 "BENT TOOTH"

Eliminates accelerated wear of 4th shaft. Use to prevent peening or to reuse O/D shaft.



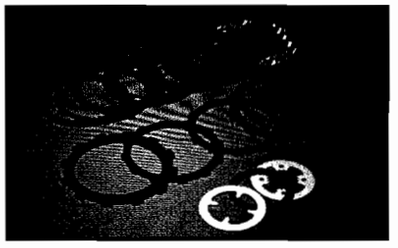
### G-4EAT LOW/REVERSE DRUM SAVER

Reuse worn reverse drum.



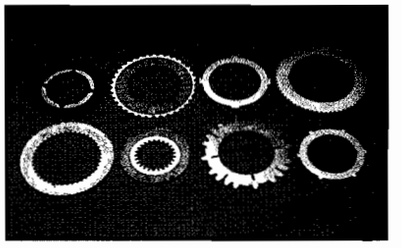
### E4OD CLEARANCE KIT

Reduces the clearance in all three drums.



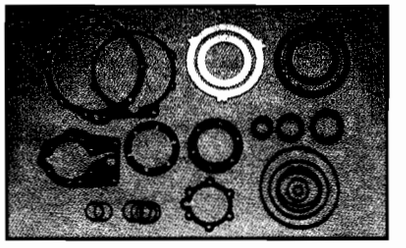
### MOTORCYCLE

Complete line of motorcycle clutches including Harley Davidson.



### INDUSTRIAL

Complete line of industrial plates.



### MARINE

Complete line of marine transmission parts.

**Alto Products Corp.** • 832 Ridgewood Avenue • PO Box 74778 • North Brunswick • NJ • 08902
Phone: 908-249-3633 • Fax: 908-745-7774 • International: 908-249-3725

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land Diameter and Length**

**1.** Dia. .318" Length .305"
**2.** Dia. .589" Length .435"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .220"

Land "1" goes into valve body first. Non machined flat around diameter of land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.201" |
| Inside Dia. | .655" |
| Outside Dia. | .787" |

I.D. Recess with one ring.

**Spring**

| | |
|---|---|
| Free Length | 1.675" |
| Inside Dia. | .434" |
| Outside Dia. | .548" |
| Wire Dia. | .057" |

No. of Coils 10

**Boost Plug**
Overall Length of Plug 1.575"

**Land Diameter and Length**

**5.** Dia. .654" Length .118"
**6.** Dia. .599" Length .374"

Spring seat goes over the stem. One I.D. ring next to land "5" in back of the machined area on the stem shown in Figure 54 below.

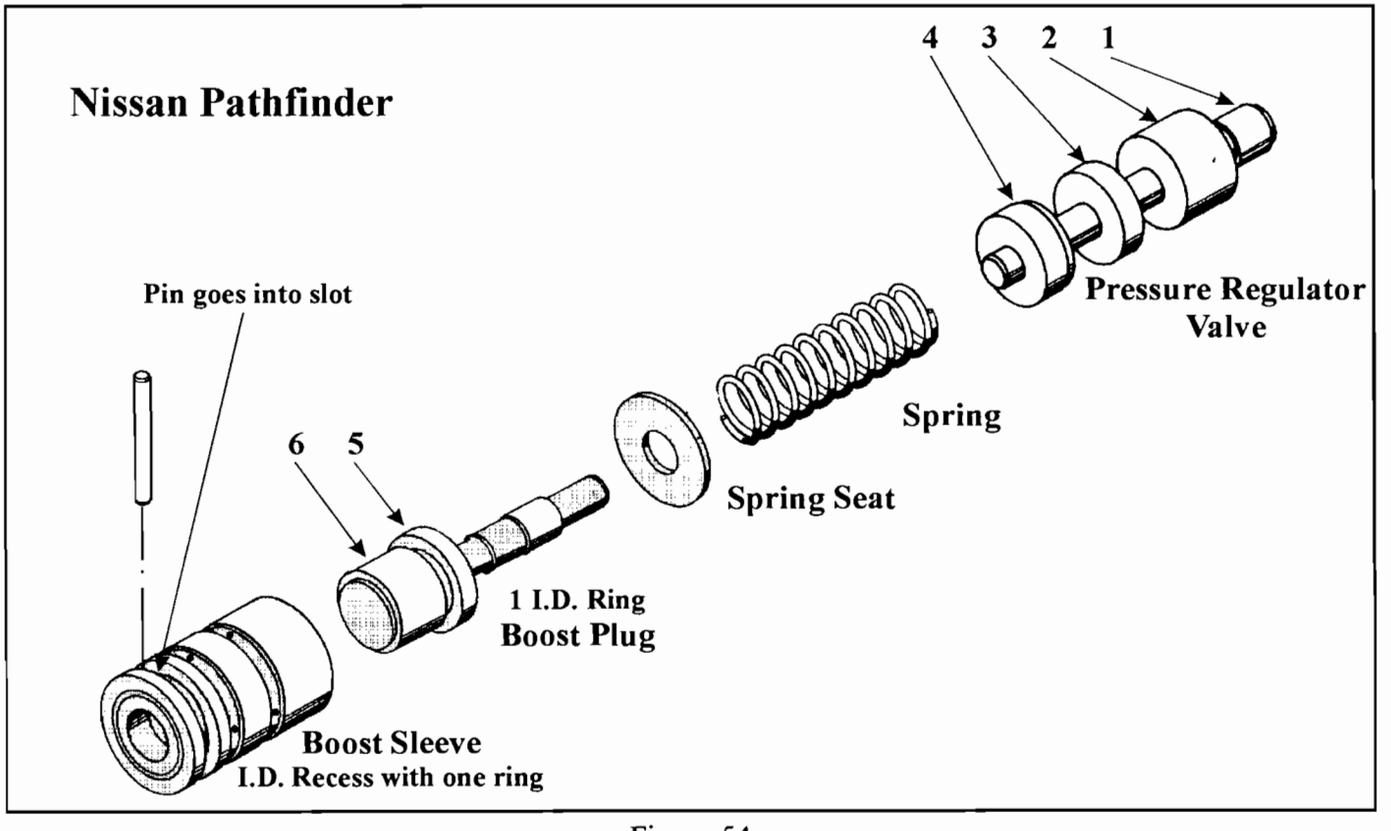



Figure 54

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land Diameter and Length**

**1.** Dia. .318" Length .288"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .280"

Land "1" goes into valve body first. Non machine flat around diameter of land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | .959" |
| Inside Dia. | .598" |
| Outside Dia. | .781" |

I.D. No recess no ring

**Spring**

| | |
|---|---|
| Free Length | 1.651" |
| Inside Dia. | .435" |
| Outside Dia. | .549" |
| Wire Dia. | .057". |

No. of coils 10

**Boost Plug**
Overall Length of Plug 1.575"

**Land Diameter and Length**

**5.** Dia. .597" Length .118"
**6.** Dia. .518" Length .374"

Spring seat goes over the stem. No I.D. rings on the boost plug (See Figure 55 below).

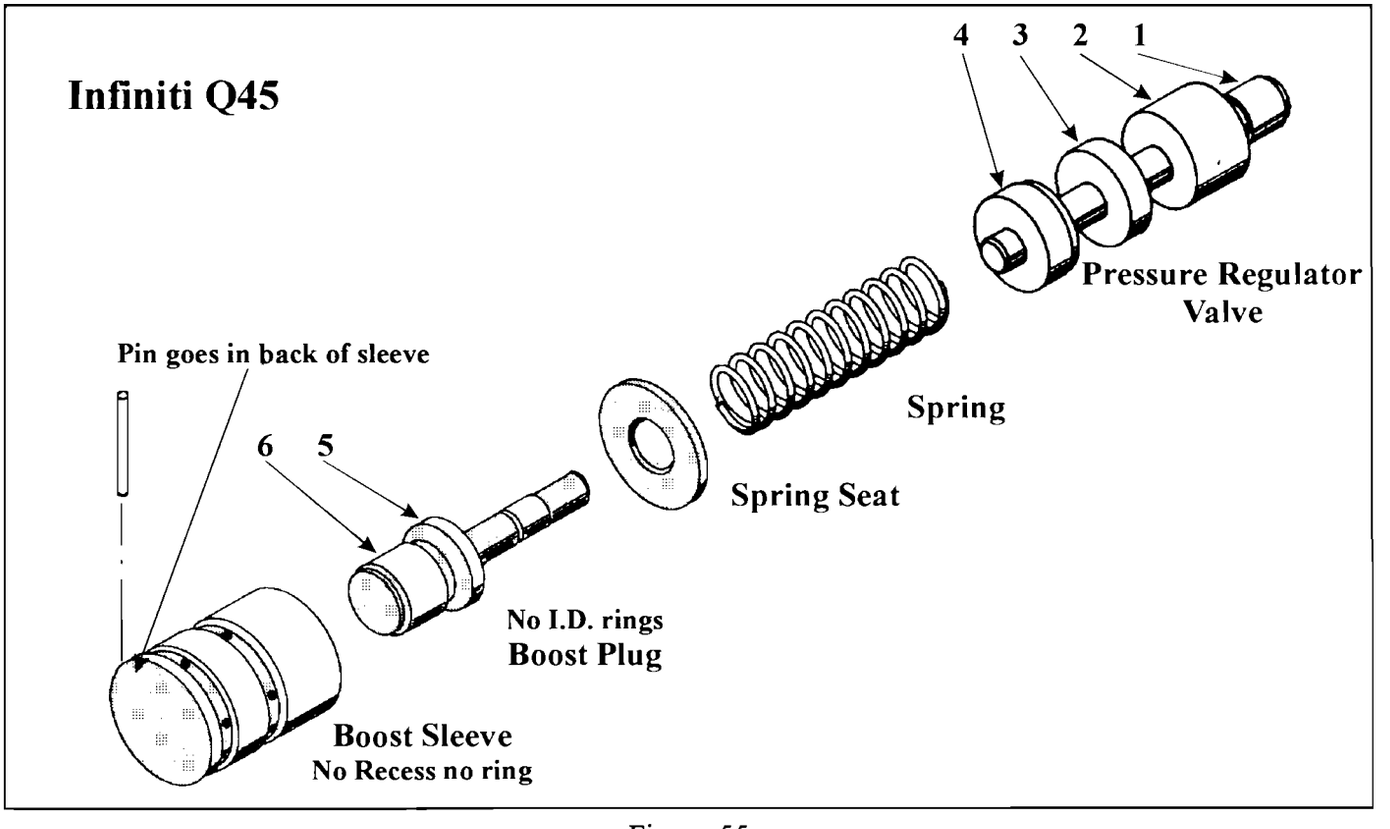



Figure 55

# RE4RO1A
## PRESSURE REGULATOR VALVES

**Pressure Regulator Valve**
Overall Length of Valve 2.090"

**Land Diameter and Length**

**1.** Dia. .318" Length .288"
**2.** Dia. .589" Length .437"
**3.** Dia. .589" Length .177"
**4.** Dia. .589" Length .280"

Land "1" goes into valve body first. Non machined flat around diameter on land "4".

**Boost Sleeve**

| | |
|---|---|
| Overall Length | 1.201" |
| Inside Dia. | .661" |
| Outside Dia. | .787" |

I.D. No recess no ring.

**Spring**

| | |
|---|---|
| Free Length | 1.669" |
| Inside Dia. | .405" |
| Outside Dia. | .519" |
| Wire Dia. | .057" |

No. of Coils 11.

**Boost Plug**
Overall Length of Plug 1.575"

**Land Diameter and Length**

**5.** Dia. .660" Length .120"
**6.** Dia. .648" Length .374"

Spring seat goes over the stem. Two I.D. rings one next to land "5" in back of machined area. One near the end of the stem in front of machined area shown in Figure 56 below.

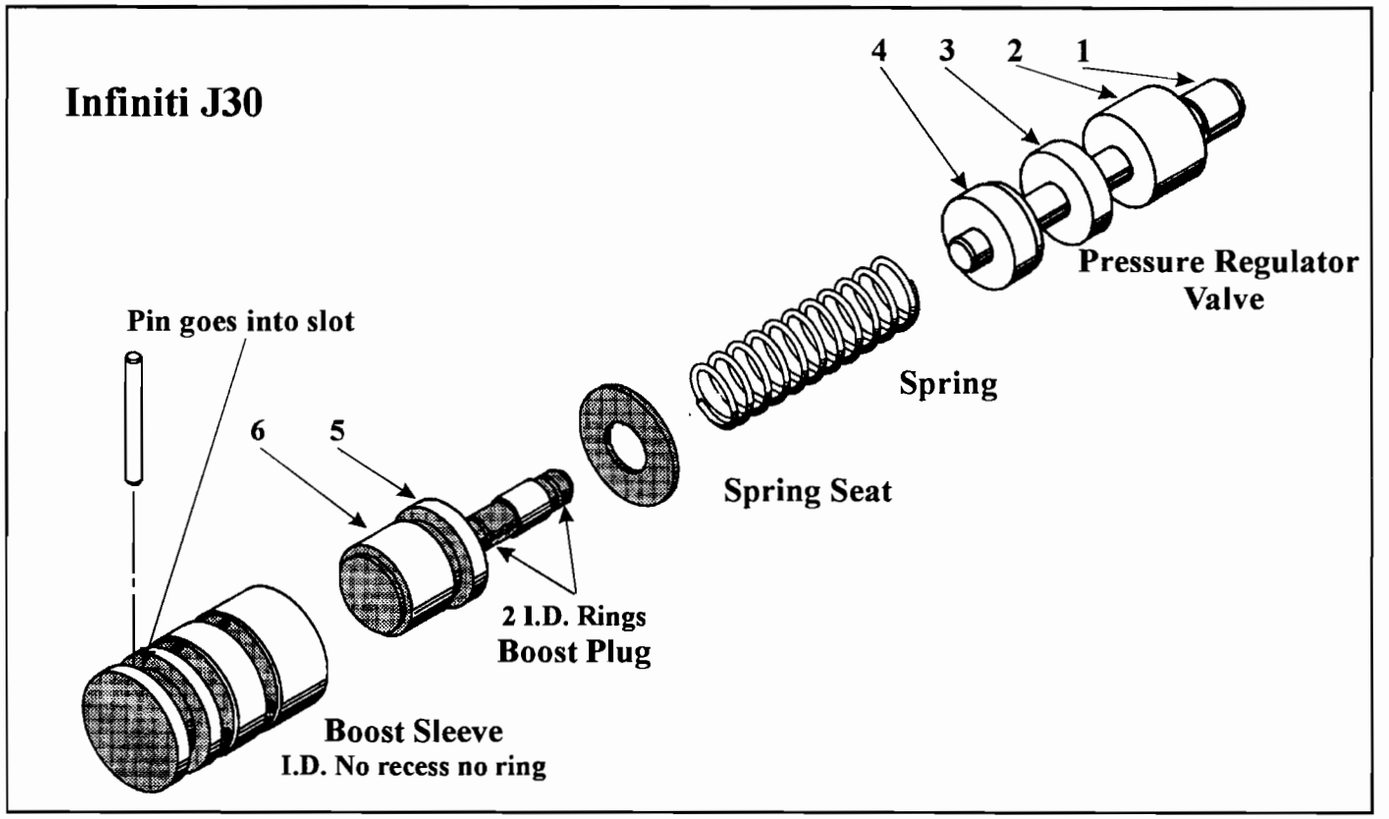



Figure 56

# NISSAN RE4R01A
## NEW DESIGN LOW SPRAG INNER RACE AND NEEDLE BEARING ASSEMBLY

CHANGE: The Low Sprag Inner Race (Rear Support) was reduced in overall height by approximately .035" on all RE4R01A A transmissions, to accommodate a new design three piece needle bearing (See Figure 57).

REASON: Greatly improved thrust bearing durability, and revised lube flow.

PARTS AFFECTED:

(1) LOW SPRAG INNER RACE (REAR SUPPORT) - Reduced in overall height by .035", to accommodate the new design (Thicker) three piece needle bearing (See Figure 57 ). The new design inner race also has revised lubrication holes. There are currently two lube holes in the new design race, one feeding lube to the sprag, and one feeding lube to the forward clutch drum bushing (See Figure 57). The new design Low Sprag Inner Race (Rear Support) can be identified by the lube hole differences mentioned above (See Figure 57), and/or by measuring the overall height, as shown in Figure 58.

(2) NEEDLE BEARING - The previous two piece needle bearing located between the overrun clutch huband the low sprag race, was replaced with the three piece design (See Figure 57).

INTERCHANGEABILITY:

The new design Low Sprag Inner Race and the three piece needle bearing will retrofit back on ALL models, AS LONG AS THEY ARE USED TOGETHER AS A SET.

The previous design and new design parts CANNOT be mismatched, or it WILL result in premature bearing failure, and/or end play concerns.

SERVICE INFORMATION:

Low Sprag Inner Race (New Design) ..... 31472-41X01
Three Piece Bearing (New Design)..... 31407-41X11

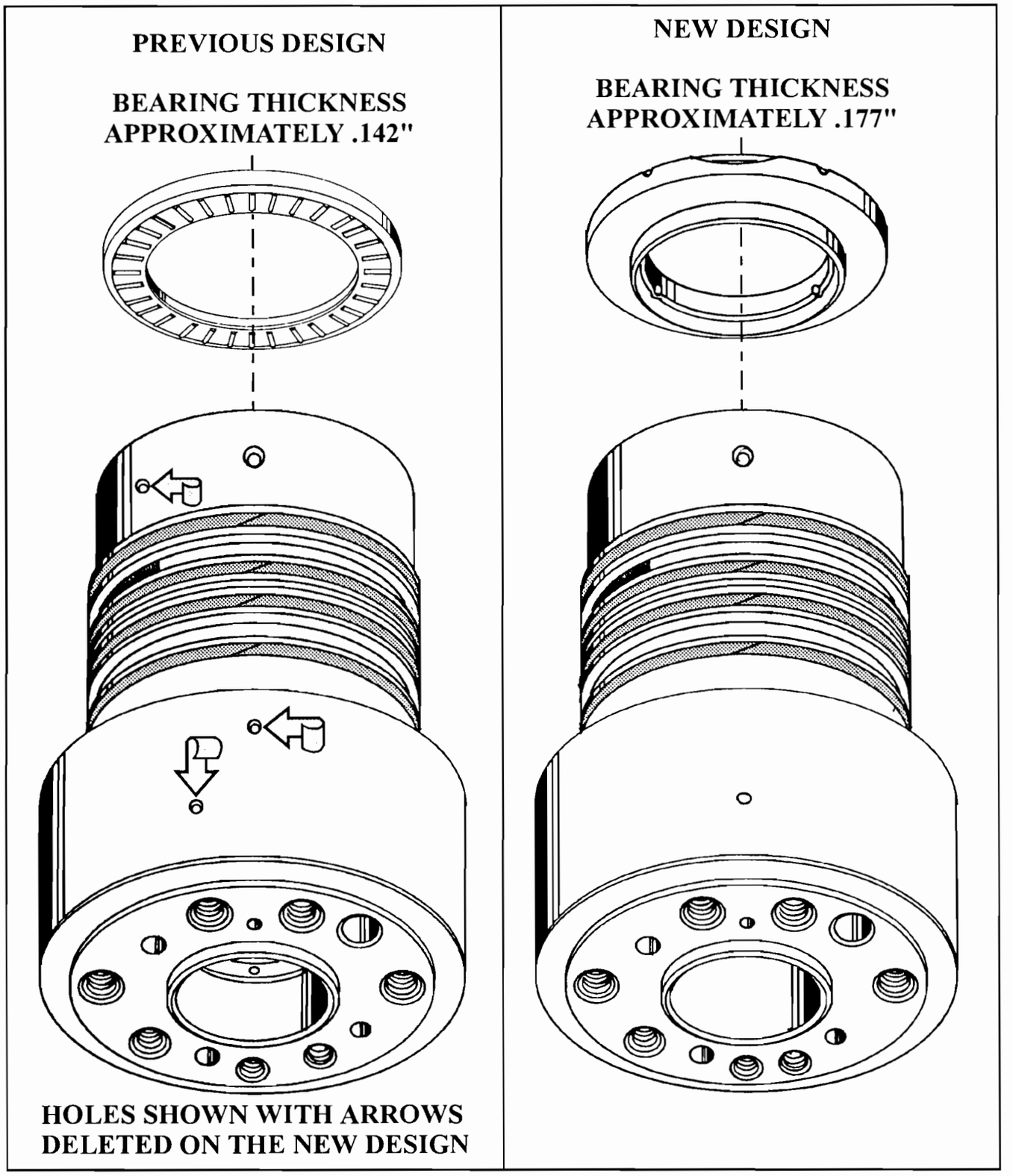
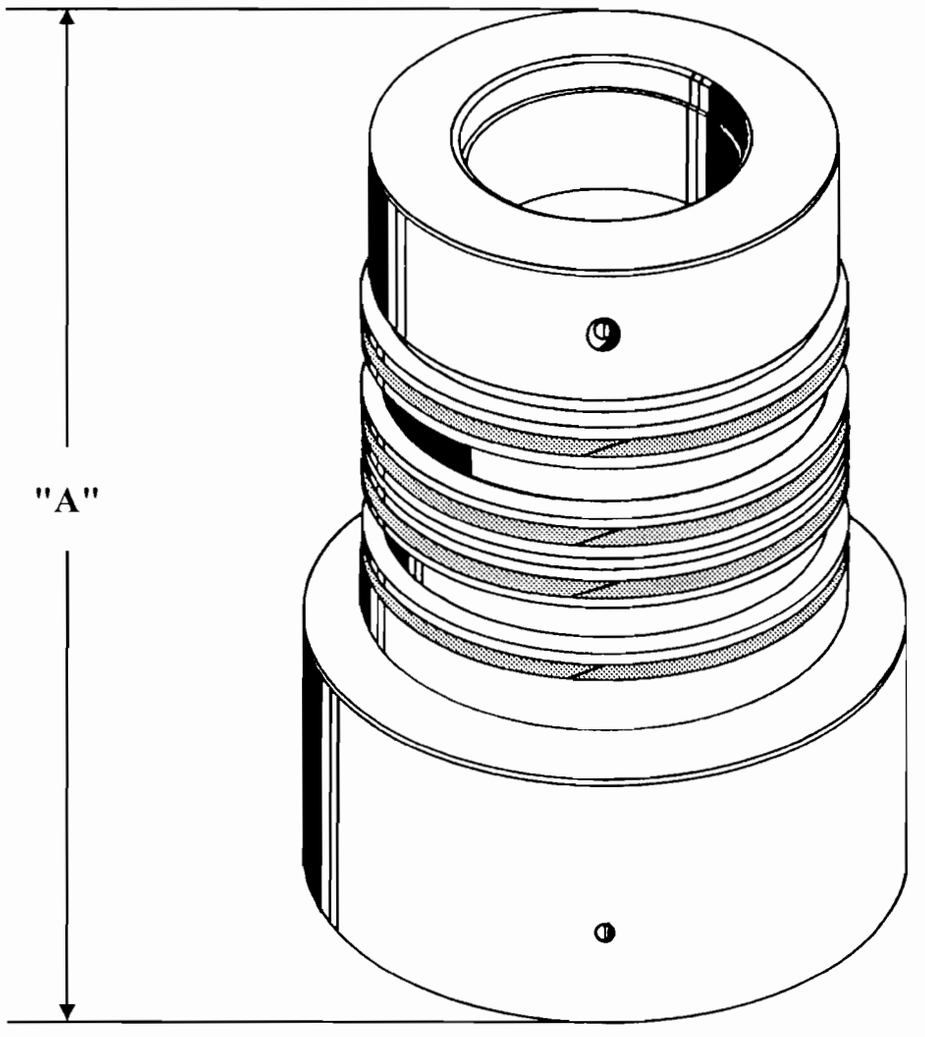

PREVIOUS DESIGN
BEARING THICKNESS APPROXIMATELY .142"
NEW DESIGN
BEARING THICKNESS APPROXIMATELY .177"
HOLES SHOWN WITH ARROWS DELETED ON THE NEW DESIGN

Figure 57




**DIMENSION "A" EARLY MODELS = 3.635"**
**DIMENSION "A" LATE MODELS = 3.600"**
Dimension "A" = The bearing surface to bolt surface.

Figure 58

# NISSAN RE4RO1A
## BEARING CHANGE

CHANGE: The three piece needle bearing located at the rear of the low one way clutch inner race in RE4RO1A transmissions has changed (See Figure 59).

REASON: Improved durability.

PARTS AFFECTED:

The previous design 3 piece bearing has been replaced by 2 thrust washers (See Figure 60).

INTERCHANGEABILITY:

The 2 new design thrust washers will retrofit backwards. These thrust washers must be used in a pair. If not, premature bearing failure, lubrication and or end play problems will arise.

SERVICE INFORMATION:

THRUST WASHER (NEW DESIGN - 2 REQUIRED).....31508-4lX01
NEW LOW EXPANSION RINGS.....31525-41X00

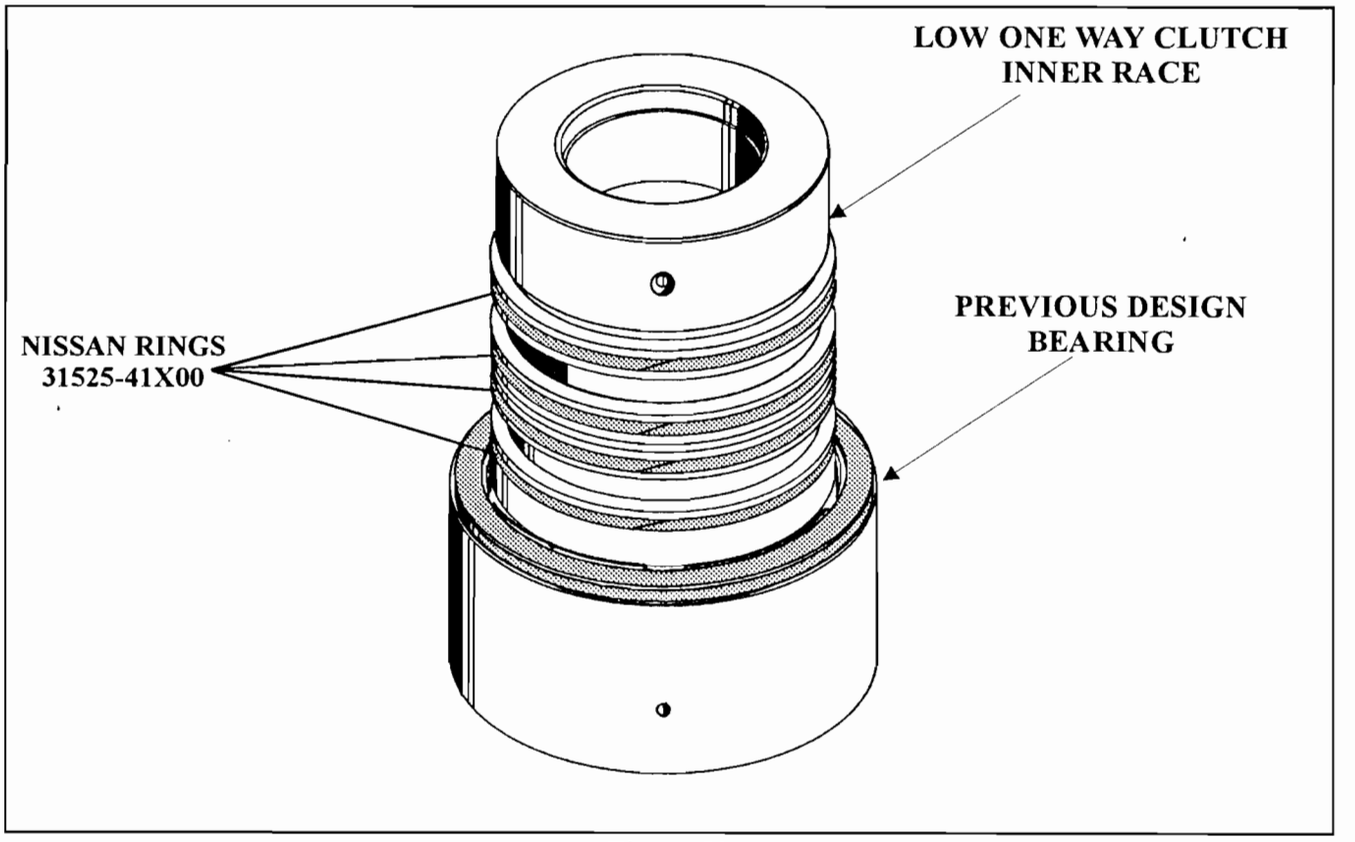



Figure 59

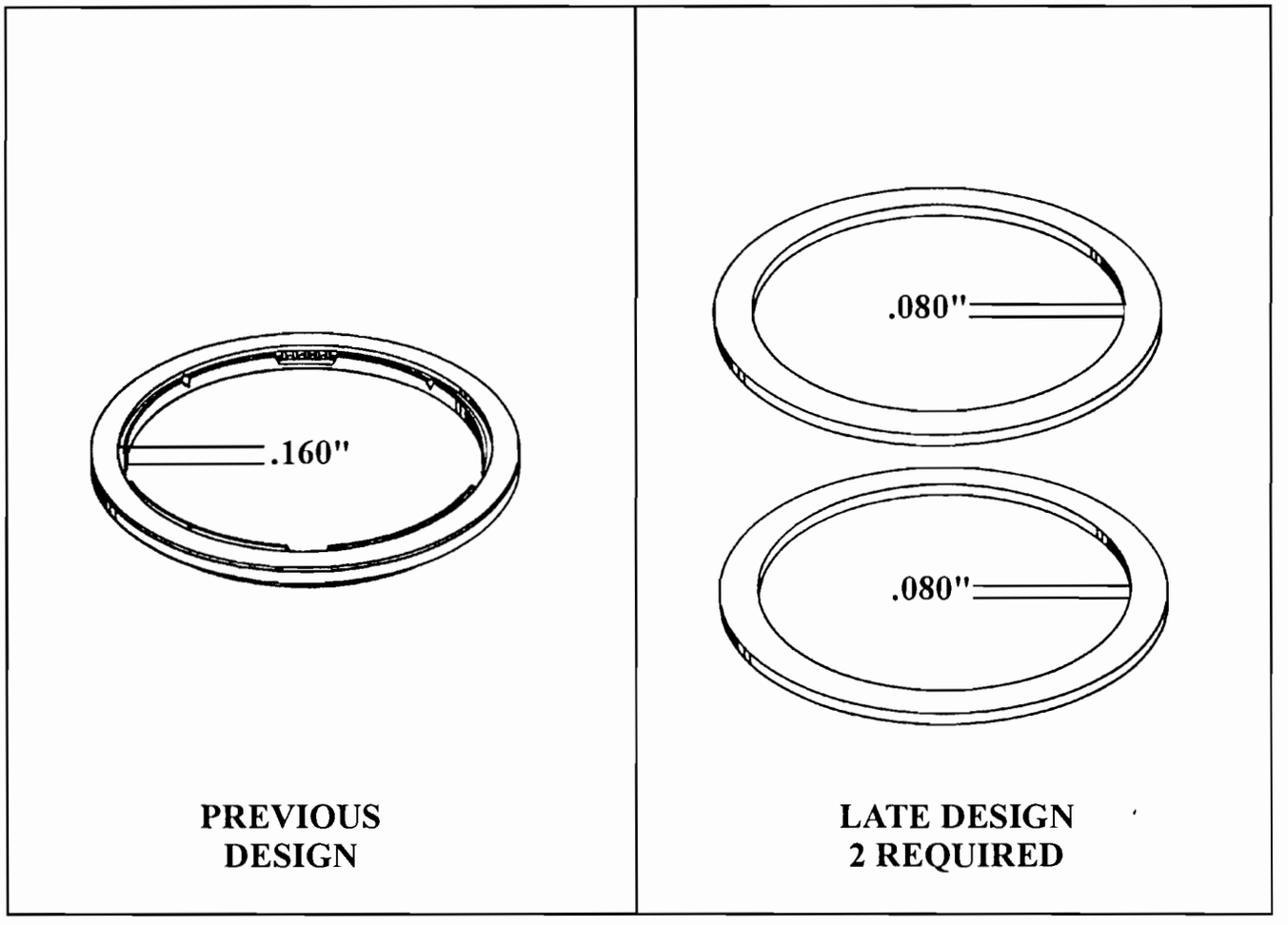



Figure 60

# NISSAN RL4RO1A
## BIND UP ON THE 3 - 4 SHIFT

**Complaint:** After overhaul an RL4RO1A may exhibit a bind-up condition on the shift from 3rd to 4th gear.

**Cause:** One cause may be the 3-4 shift plug installed backwards, when cleaning and assembling the valve body during overhaul. With the 3-4 shift installed backward line pressure is directed through the overrun clutch reducing valve and into the overrun clutch on a 3-4 upshift. The bind up occurs, when the overrun clutches are applied at the same time as the direct clutch and the 2/4 band. Burning of the overrun clutches may also be evident.

**Correction:** Install the valve correctly as shown in Figure 61 below.

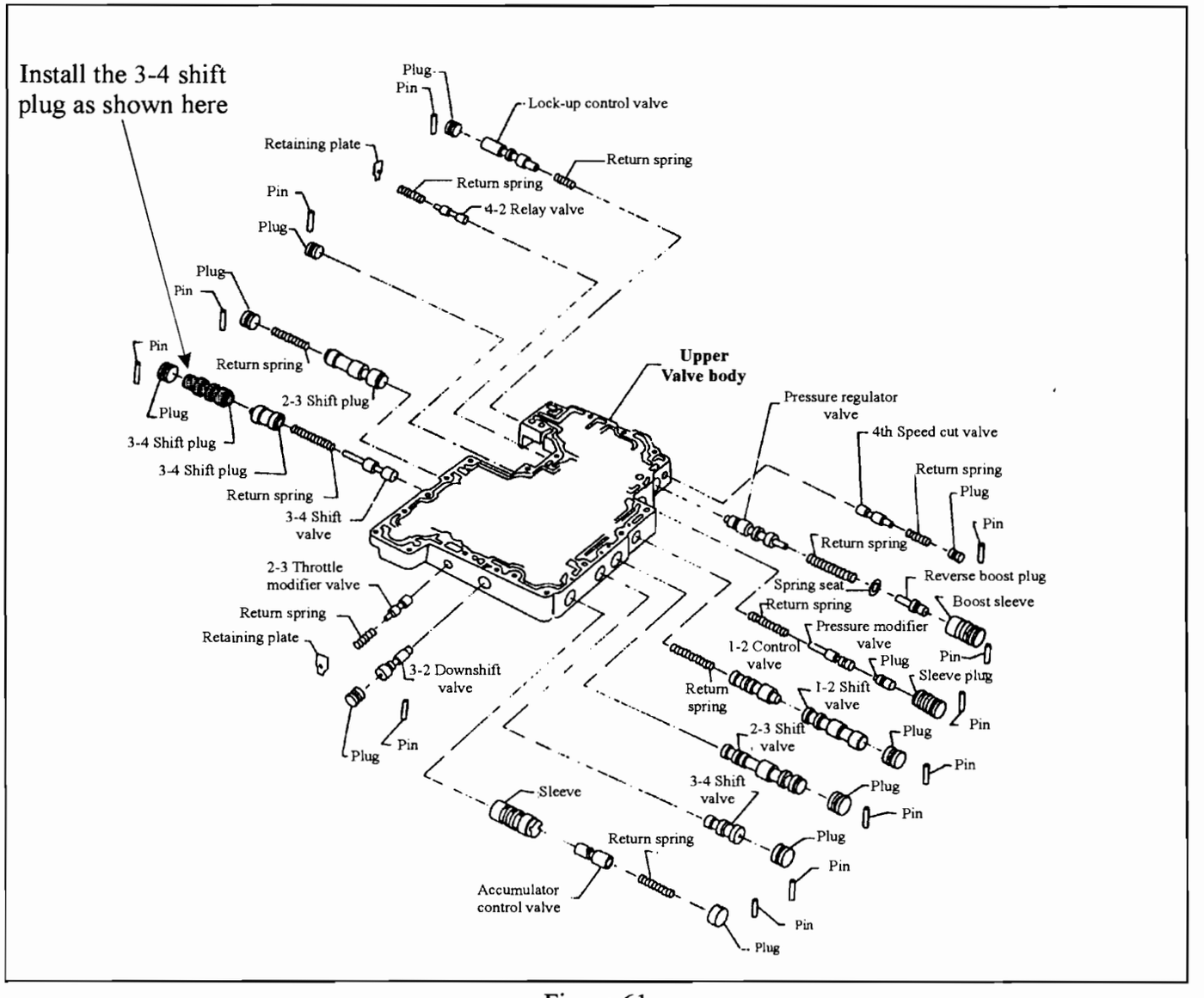



Figure 61
*Automatic Transmission Service Group*

# NISSAN MAXIMA AND STANZA RE4FO2A
## TRANSMISSION SHIFTS 1 - 2 - NEUTRAL

**Complaint:** After overhaul a Nissan Maxima or Stanza equipped with an RE4FO2A automatic transaxle may exhibit a 1 to 2 to 1 shift sequence that feels like a shift to neutral. No electrical problem is evident.

**Cause:** One cause may be a checkball installed into a bathtub that does not require a checkball. (See Figure below for the location of the checkball in question). In order for this location to require a checkball, there must be two holes in the separator plate above the bathtub (See Figure ). When a checkball is mistakenly installed in this location, the checkball will act as a one way valve and trap oil going to the face side of the 2 - 3 shift valve keeping the valve in against spring tension. This prevents a 2 - 3 upshift from taking place and a shift from 2 - 1 will occur.

**Correction:** Look at the diagram of the separator plate in Figure to determine if the valvebody requires a ckeckball or not. One hole in the separator plate will not require a checkball. Two holes in the separator plate will require a checkball. A picture of the hydraulic circuit is also provided in Figure on the next page.

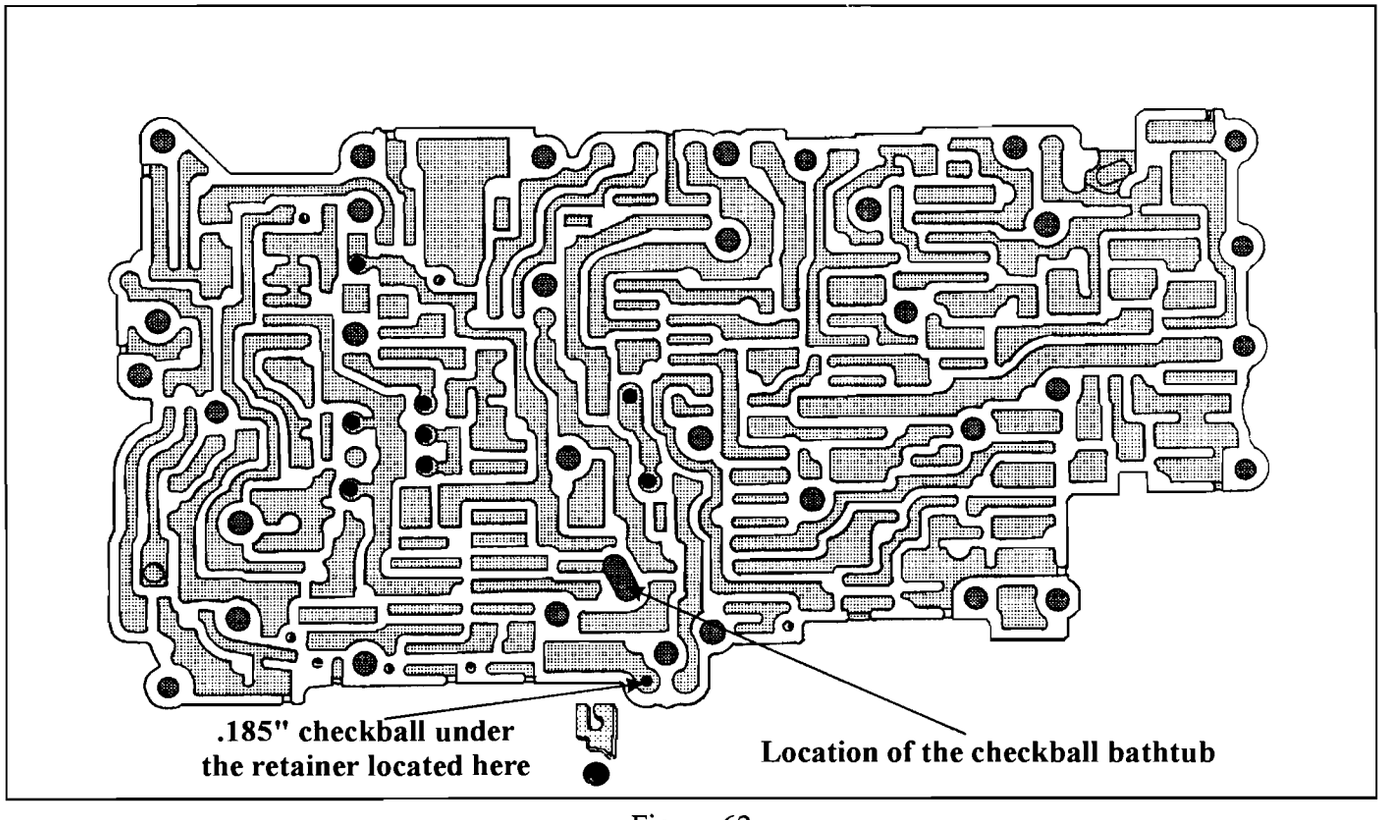



Figure 62
*Automatic Transmission Service Group*

# NISSAN MAXIMA AND STANZA RE4FO2A
## TRANSMISSION SHIFTS 1 - 2 - NEUTRAL

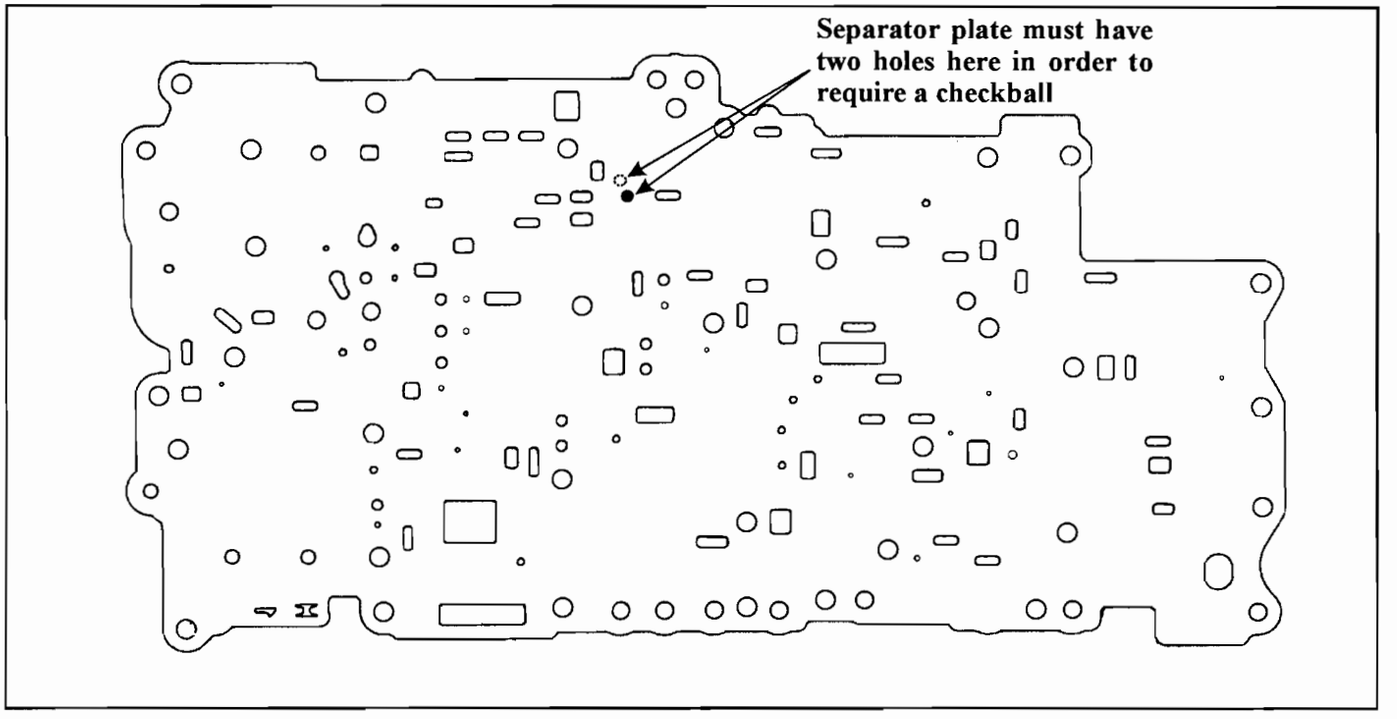



Figure 63

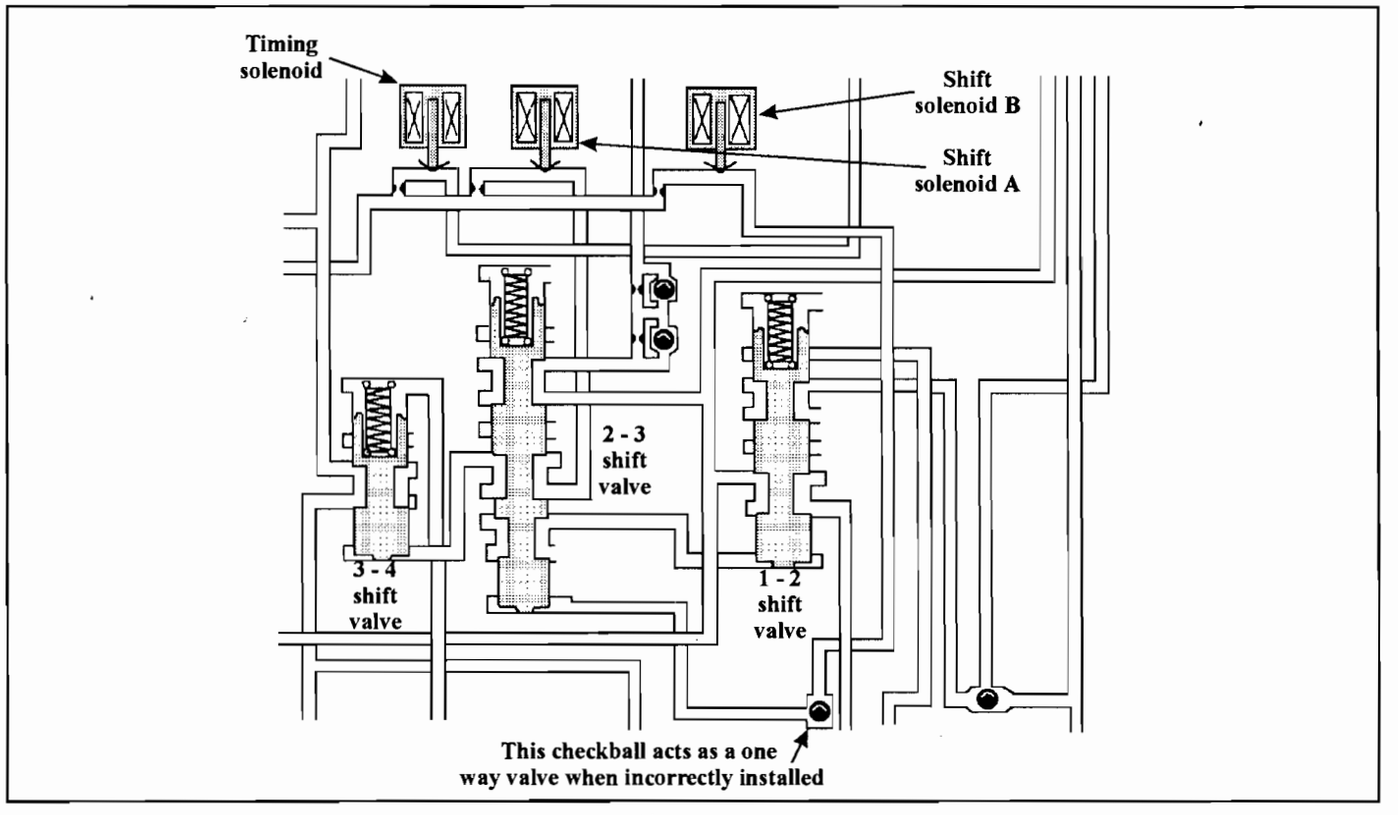



Figure 64

# NISSAN, RE4FO2A - RE4RO1A
## NO LINE PRESSURE RISE

**Complaint:** After an overhaul, an RE4F02A or RE4R01A transmission has no line pressure rise. When the connector for the solenoids is disconnected line pressure rises to approximately 190 - 200 psi. at a closed throttle.

**Cause:** One cause may be a faulty dropping resistor. A dropping resistor is an inline resistor that receives computer variable voltage and reduces or "Drops" the voltage down to an acceptable range that the pressure control solenoid can handle.

**Correction:** Check the dropping resistor circuit or replace the dropping resistor. To properly check the dropping resistor and to locate the resistor on various models, see accompanying text and Figures 65 and 66. To begin checking the dropping resistor place the leads of a DVOM. across terminals "A" and "B" with the connector disconnected, as shown in Figure 65. The resistance should be between 11.2 and 12.8 ohms. Voltage can be checked coming from the computer to the dropping resistor, as well as the voltage being sent to the pressure control solenoid. To check the voltage being sent from the computer, start the engine and warm it up to operating temperature, and then shut it off. With the connector plugged into the harness, use a voltmeter and with the positive lead of the meter, carefully backprobe terminal "A" of the connector (This is the receiving terminal coming from the transmission computer) place the negative lead of the meter to the negative terminal of the battery, or a good known ground. Set the meter on DC volts. Turn the ignition to the ON position (Do not start) and note the voltage that is shown on the meter screen. Depending on engine temperature, the reading should be between 7.0 and 13.0 volts with the throttle closed. As soon as the throttle is opened, the voltage will begin to drop. With a 30% throttle opening approximately 4.0 volts should be present **(It may be noticed that the voltage does not drop smoothly, this is normal operation. The voltage drop will seem erratic, unlike TPS voltage which should be smooth)**. When 50% throttle is reached, there should be approximately 0.5 volts. This voltage should remain at approximately 0.5 volts all the way to wide open throttle. Next place the positive lead of the meter to terminal "B" of the connector at the dropping resistor. Keep the negative lead on a good known ground. At a closed throttle the voltage should be between 2.0 and 3.5 volts. **(This voltage drop will also be erratic)**. The voltage should drop slowly until approximately 50% throttle is reached. The voltage should then drop to approximately 0.5 volts and remain at 0.5 volts all the way to wide open throttle. All voltage readings should fluctuate with engine temperature. If the voltage at terminal "A" is correct, and voltage at terminal "B" is incorrect, the dropping resistor is bad causing no line pressure rise. If the voltage at terminal "A" is incorrect, a malfunctioning TPS or a bad computer may be the cause of the problem. If voltage at terminal "B" is at 0.00 volts at all throttle ranges, and voltage at terminal "A" is at 5.00 volts at all throttle ranges, a shorted wire or an open in the circuit will be the cause of this problem. This fault will not cause a no pressure rise, but rather a constant high line pressure regardless of throttle opening.

# NISSAN, RE4FO2A - RE4RO1A
## NO LINE PRESSURE RISE

| | |
|---|---|
| Infiniti I30: | Right hand side of the engine compartment on a bracket by the battery. |
| Infiniti J30: | Right hand side of the engine compartment on a bracket by the battery. |
| Infiniti Q45: | Right hand side of the engine compartment on a bracket by the battery. |
| Mazda MPV: | Driver side rear corner of the engine compartment. |
| Mazda Pickup: | Front of the engine compartment near the headlight, on the left side of the radiator. |
| Mazda RX7: | Front side of the right shock tower above manifold. |
| Mazda 929: | Front side of the right shock tower, below manifold. |
| Nissan Maxima: | Under air filter box on the driver side of the engine compartment |
| Nissan Pathfinder: | Passenger side fender well behind the battery. |
| Nissan Pickup: | Passenger side fender well behind the battery. |
| Nissan Stanza: | Under air filter box on the driver side of the engine compartment. |
| Nissan 240sx: | Left front corner of the engine compartment, behind the air box, near the ignition coil. |
| Nissan 300zx: | Behind the plastic inner lining above the right front tire. |
| Nissan 300zx Turbo: | Behind the plastic inner lining above the right front tire. |

Figure 65

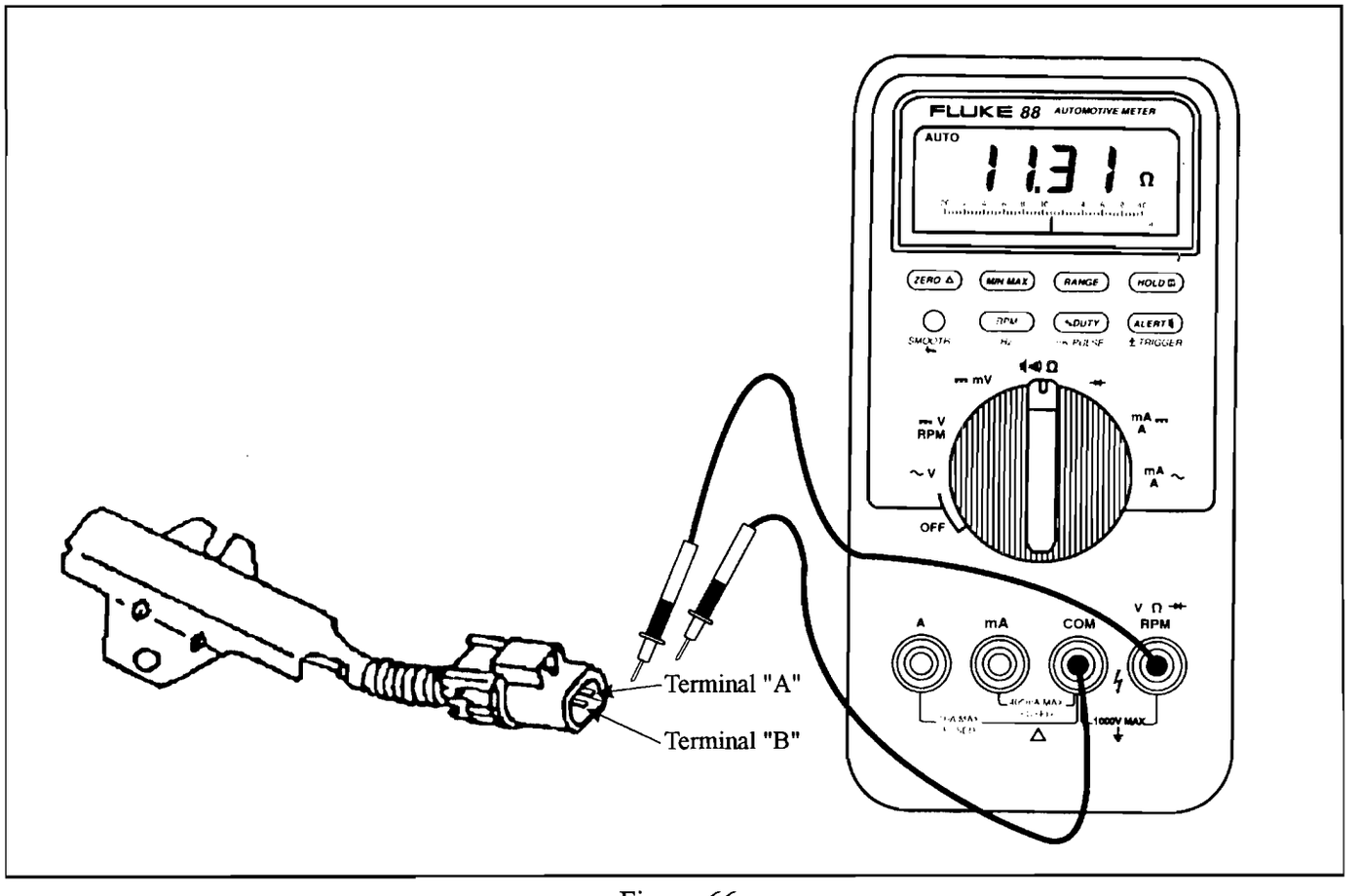



Figure 66

# SPRINT MX17
## LATE SHIFTS OR NO KICKDOWN

**COMPLAINT:** Before and/or after overhaul, the transaxle may experience late upshifts or no kickdown.

**CAUSE:** One cause may be a faulty vacuum switch assembly.

**CORRECTION:** All Sprint vehicles are equipped with a vacuum switch assembly which signals to the computer throttle position information based on manifold vacuum (See Figure 67). This vacuum switch assembly is located on the passenger side of the firewall behind the air cleaner. A plastic box is used as a cover for protection. To check the switch assembly, remove both the cover and vacuum switch assembly from the firewall and perform the following test using a vacuum pump and ohm meter:

1. Place a vacuum pump onto the main vacuum supply hose to the switches. With an OHM meter set to continuity, place the negative lead to the black wire for the entire test routine. Place the positive lead onto the blue wire. The meter should read continuity (0 ohms). When 2.5 to 3.5 inches of vacuum is pumped up, the meter should go to infinite (No reading).
2. Lock the vacuum pump to hold the 2.5 to 3.5 inches of vacuum and move the positive lead of the meter to the green wire. The meter should show continuity and go to infinity when the vacuum pump is brought up to 6.5 to 7.5 inches.
3. Lock the vacuum pump at 6.5 to 7.5 inches and place the positive meter lead to the brown wire. The meter should show continuity and go to infinite when the vacuum pump is brought up to 11.5 to 12.5 inches of vacuum.

Replace the vacuum switch assembly if the above test procedure has failed.

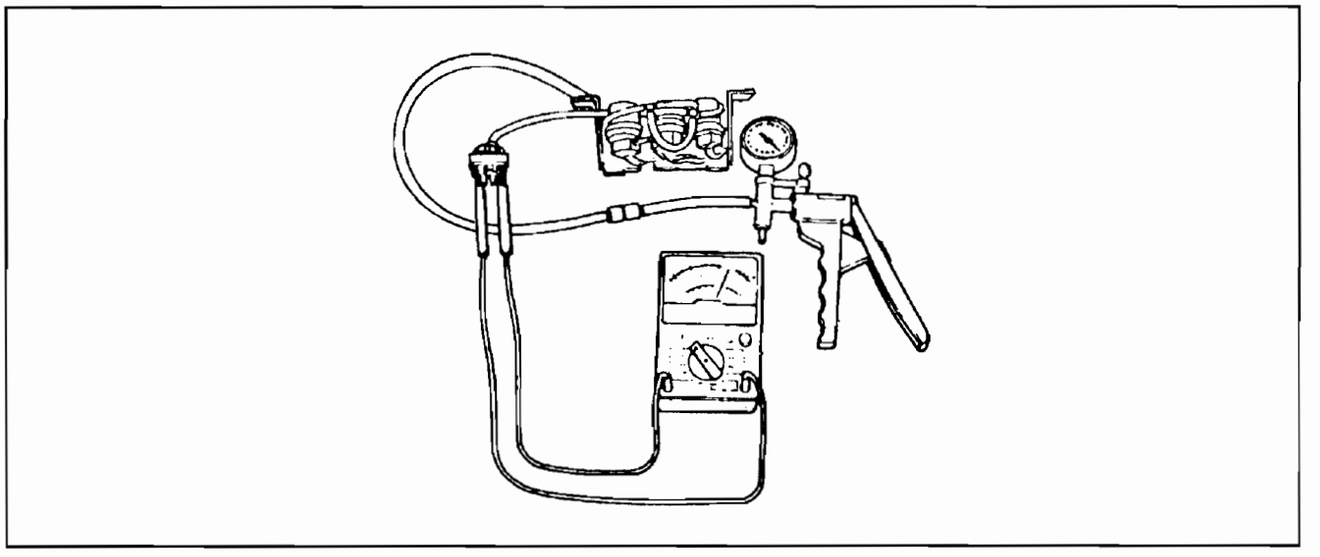


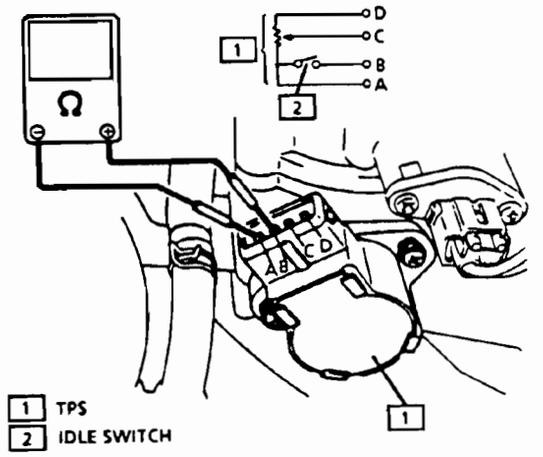
Figure 67

# MX17
## LATE OR EARLY UPSHIFTS

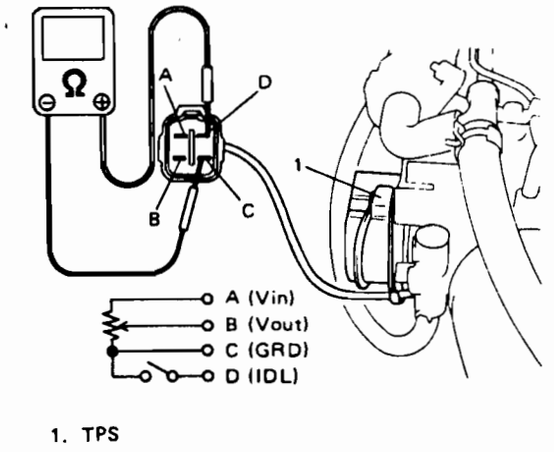
**COMPLAINT:** Vehicles Geo Metro, Suzuki Swift and a Diahatsu Charade equipped with an MX17 transaxle may experience a late, early or a no upshift condition before and/or after an overhaul.

**CAUSE:** One cause may be a bad TPS. Another cause may be a bad engine computer.

**CORRECTION:** Check the TPS for proper operation (See Figure 68). The TPS sends a typical varying voltage to the engine computer. The Engine computer then send a separate signal to the transaxle controller. If the TPS checks bad, replace it. If the TPS checks good, go to the transaxle controller and check the signal being sent to the controller by the engine computer (See Figure 69). If the signal is incorrect, replace the Engine computer.




| TERMINALS | CONDITION | RESISTANCE |
|---|---|---|
| BETWEEN A & B TERMINALS (IDLE SWITCH) | WHEN THROTTLE LEVER-TO-STOP SCREW CLEARANCE IS 0.3mm (0.012") | CONTINUITY |
| | WHEN THROTTLE LEVER-TO-STOP SCREW CLEARANCE IS 0.9mm (0.035") | INFINITE |
| BETWEEN A & D TERMINALS | THROTTLE VALVE IS AT IDLE POSITION | 4.37 - 8.13k OHMS |
| BETWEEN A & C TERMINALS | THROTTLE VALVE IS AT IDLE POSITION | 240 - 1140k OHMS |
| | THROTTLE VALVE IS FULLY OPENED | 3.17 - 6.6k OHMS |




| TERMINALS | CONDITION | RESISTANCE |
|---|---|---|
| BETWEEN C & D TERMINALS (IDLE SWITCH) | WHEN THROTTLE LEVER-TO-STOP SCREW CLEARANCE IS 0.3mm (0.012") | 0 - 500 OHMS |
| | WHEN THROTTLE LEVER-TO-STOP SCREW CLEARANCE IS 0.9mm (0.035") | INFINITE |
| BETWEEN C & A TERMINALS | ——— | 3.5 - 6.5k OHMS |
| BETWEEN C & B TERMINALS | THROTTLE VALVE IS AT IDLE POSITION | 0 - 2.0k OHMS |
| | THROTTLE VALVE IS FULLY OPENED | 3.5 - 6.5k OHMS |

Figure 68

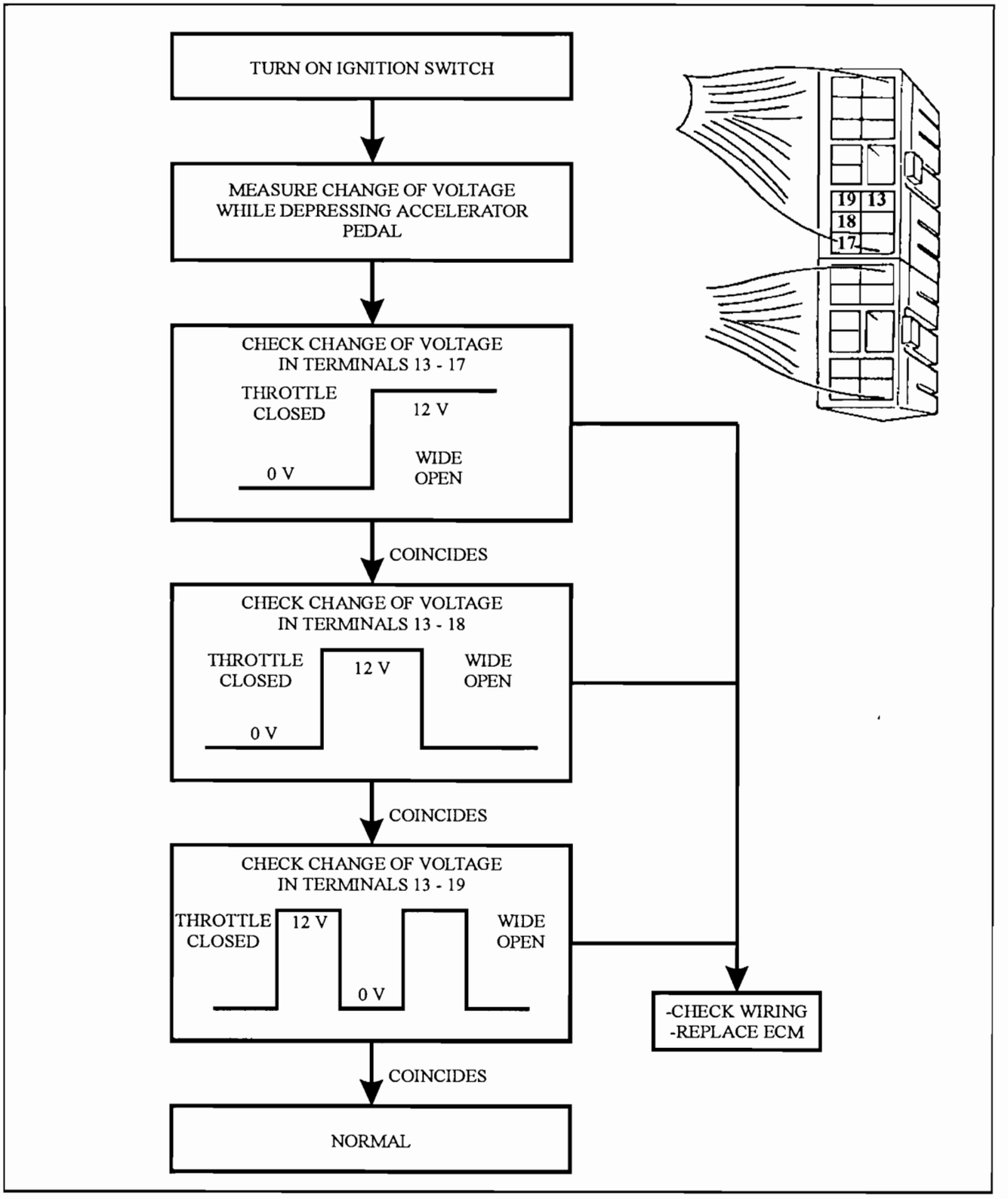

TURN ON IGNITION SWITCH
MEASURE CHANGE OF VOLTAGE WHILE DEPRESSING ACCELERATOR PEDAL
CHECK CHANGE OF VOLTAGE IN TERMINALS 13 - 17
THROTTLE CLOSED
12 V
0 V
WIDE OPEN
COINCIDES
CHECK CHANGE OF VOLTAGE IN TERMINALS 13 - 18
THROTTLE CLOSED
12 V
WIDE OPEN
0 V
COINCIDES
CHECK CHANGE OF VOLTAGE IN TERMINALS 13 - 19
THROTTLE CLOSED
12 V
0 V
WIDE OPEN
COINCIDES
NORMAL
-CHECK WIRING
-REPLACE ECM
19 13
18
17

Figure 69

# MX17
## NO REVERSE

**COMPLAINT:** Before overhaul, the vehicle experienced a no reverse condition with all forward ranges working correctly. When the transaxle was overhauled, no evidence as to why a no reverse condition existed.

**CAUSE:** One cause may be a bad controller which energizes the 2nd brake solenoid in the reverse range. This blocks Low/Reverse apply oil at the 1-2 shift valve.

**CORRECTION:** Replace the controller. There are 3 different controllers available. To order the correct controller, you must acquire code numbers off a label on the controller. A quick test to verify that the controller is defective, unplug the solenoid wire connector. If a reverse gear is achieved, the controller is defective.

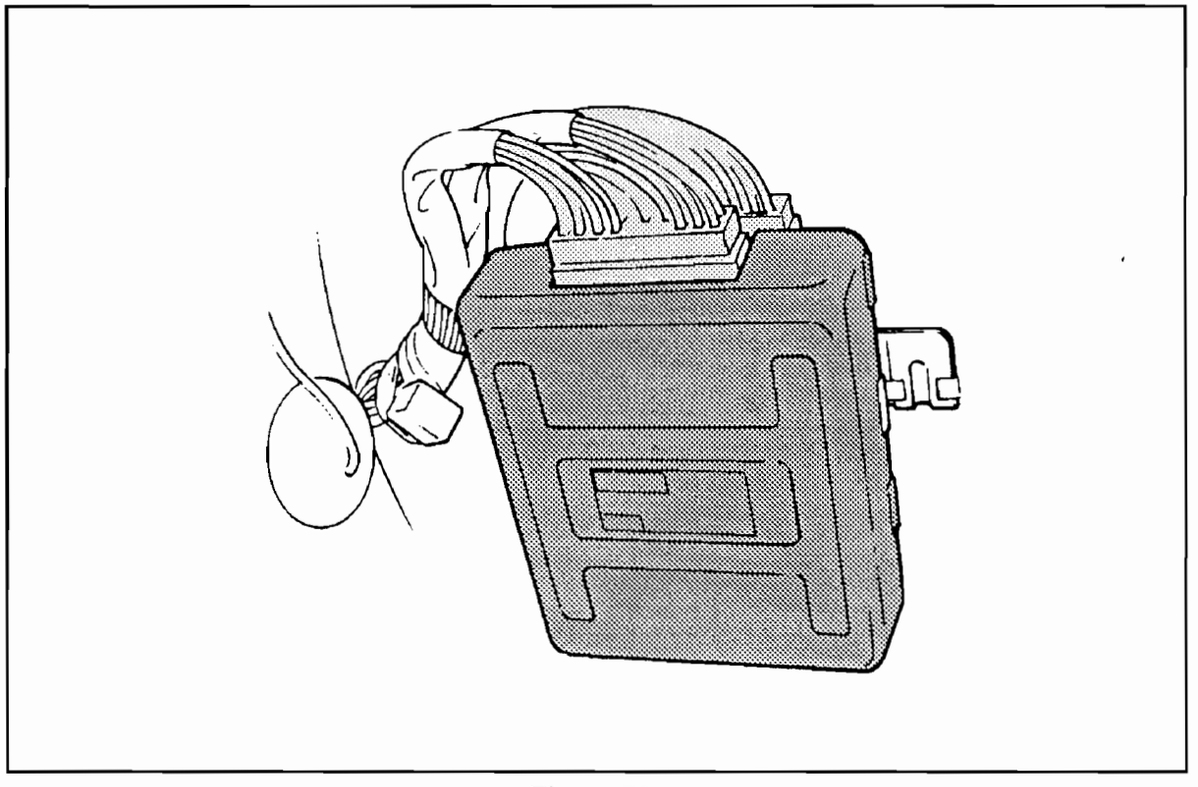


Figure 70

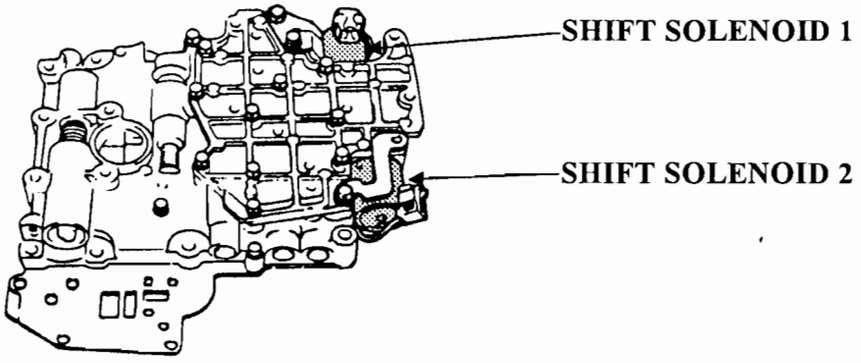
# TOYOTA 140E
## 3RD GEAR STARTS/NEUTRALS

**COMPLAINT:** *After overhaul*, vehicle exhibits a 3rd gear start, in the Drive range, and appears to neutral at aproximately 25 mph. then upshifts to 4th. after releasing the throttle at aproximately 35mph.

**CAUSE:** The cause may be, Shift Solenoid 2 wire harness was connected to Shift Solenoid 1 and Shift Solenoid 1 wire harness was connected to Shift Solenoid 2. This can be easily done by installing the wiring harness leads through the wrong opening where the valve body mounts on the case. This will actually cause a 3rd gear start a downshift to 2nd at 15mph. a downshift to 1st at 25mph. and then an upshift to 4th at 35mph.

**CORRECTION:** Refer to Figure 71 for identification and location of Shift Solenoid 1 and Shift Solenoid 2 and their ***internal*** wire harness colors.

**SHIFT SOLENOID IDENTIFICATION**
**VALVE BODY REMOVED**




**SHIFT SOLENOID LOCATION AND INTERNAL HARNESS COLORS**
**VALVE BODY INSTALLED**

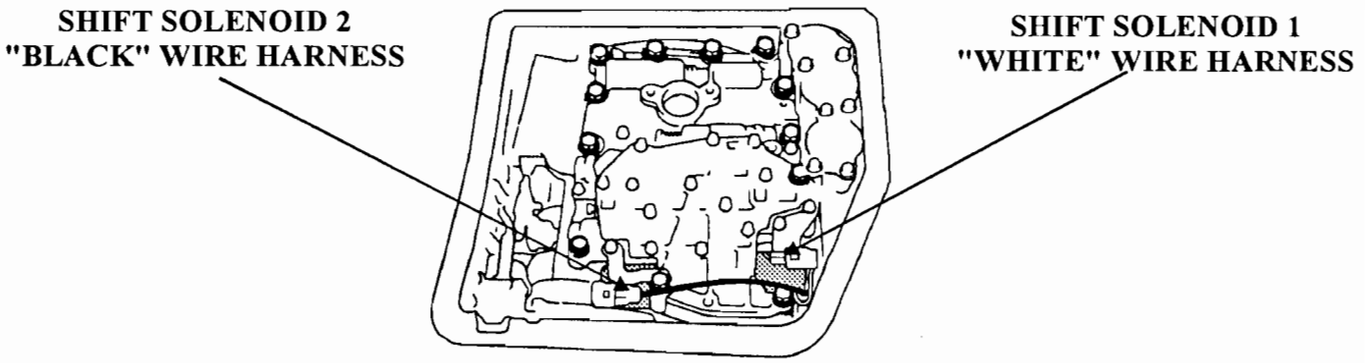
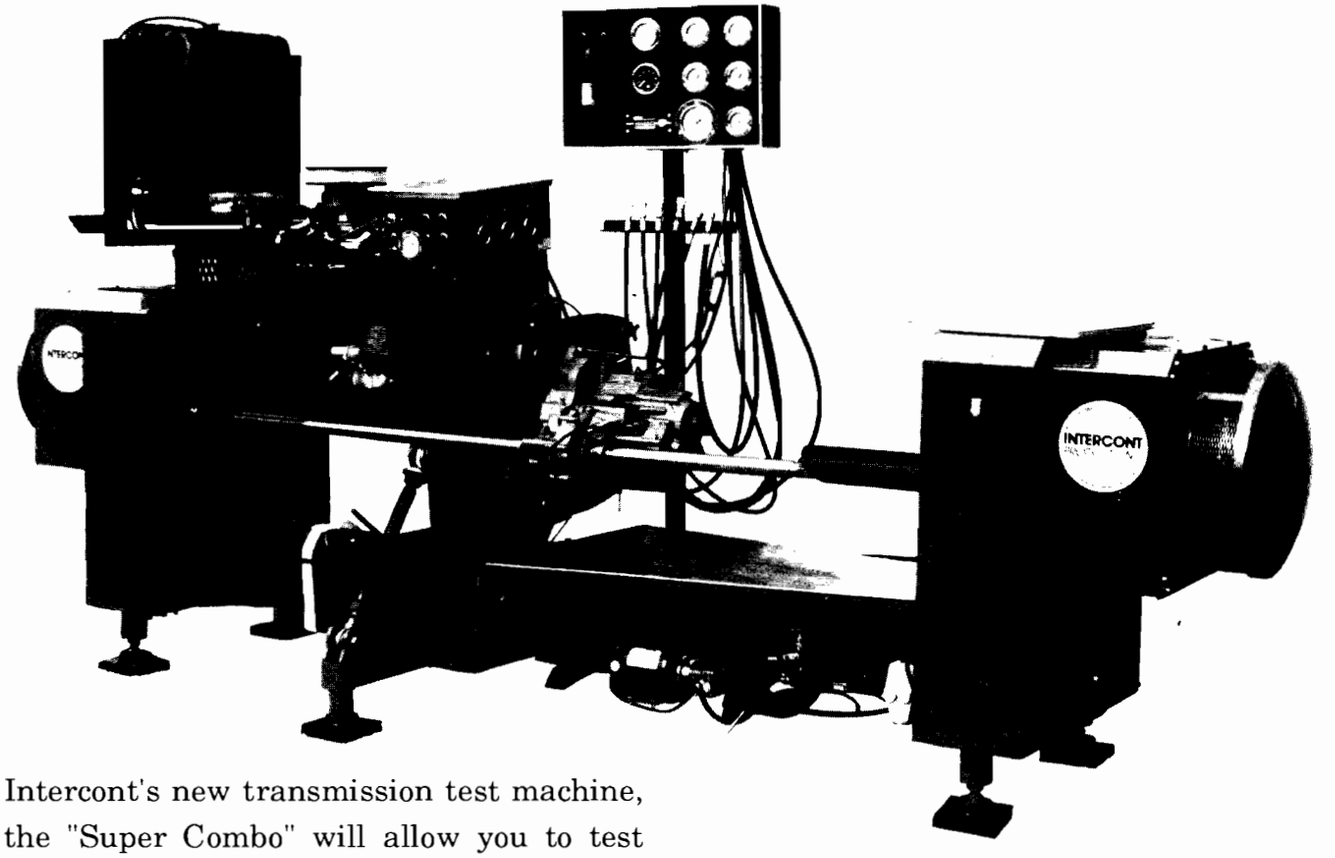



Figure 71

# TEST YOURSELF

## with Intercont's new Super Combination Transmission Test Machine

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**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 540E

## NO REVERSE

**COMPLAINT:** Before or after overhaul, vehicle exhibits:

1. "No Reverse" with forward ranges O.K.

2. "No Reverse" with no "Engine braking" in "Manual 2nd." or "Manual 1st."

**CAUSE:** The cause may be:

1. A rubber check ball was missing or was left out of the Upper valve body.

2. The "CO" or "Overdrive Direct" clutch drum, accumulator or apply gaskets, located in the Overdrive Case, were misassembled.

**CORRECTION:** Match the complaint to the correction, 1 or 2, and repair as needed.

1. Install missing check ball in the Upper valve body as shown in Figure 72.

2. Renew "Overdrive Direct" clutch drum piston seals.
   - "Bore" fit sealing rings into the Overdrive Direct drum and ensure a snug fit.
   - Check Overdrive Direct clutch accumulator "O-ring" and ensure a snug fit when installed into its bore. (See Figure 73)
   - Ensure that the Overdrive brake and Overdrive Direct clutch apply gaskets or plugs are installed between the main and Overdrive case. (See Figure 73).
   - NOTE: When air checking the Overdrive Direct clutch, through the Overdrive case, ensure that the accumulator strokes against its cover and the Overdrive Direct clutch plates apply. (See Figure 74)

**UPPER VALVE BODY CHECK BALL LOCATION**

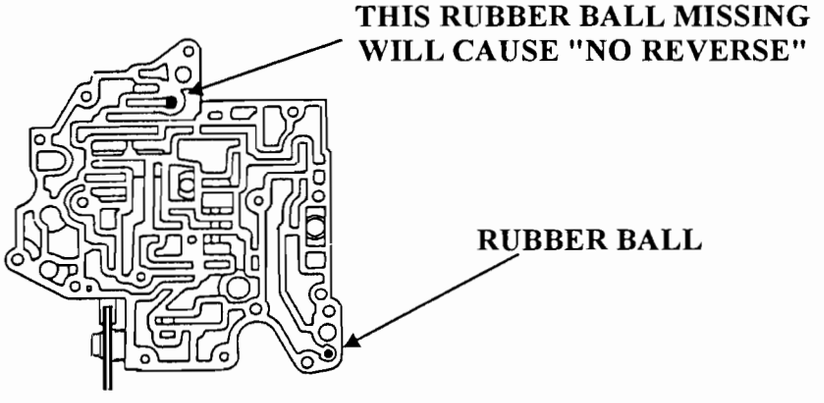



Figure 72

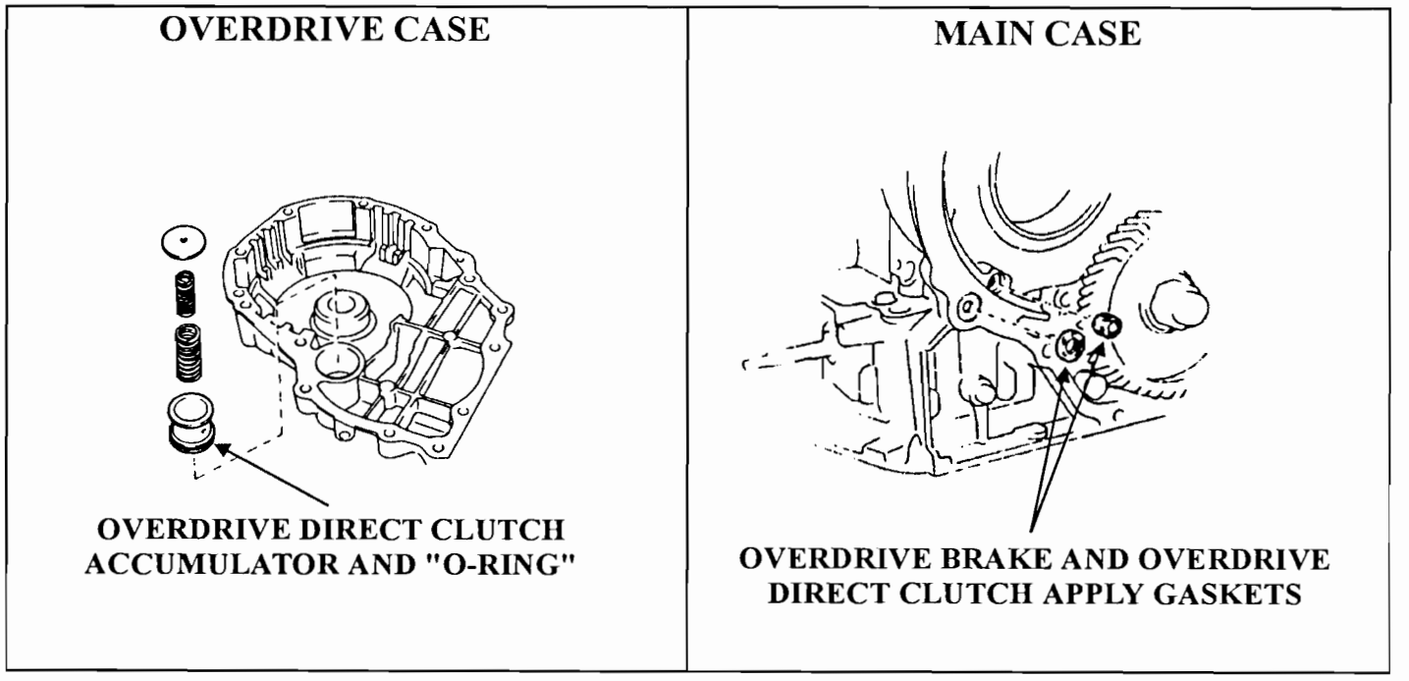



Figure 73

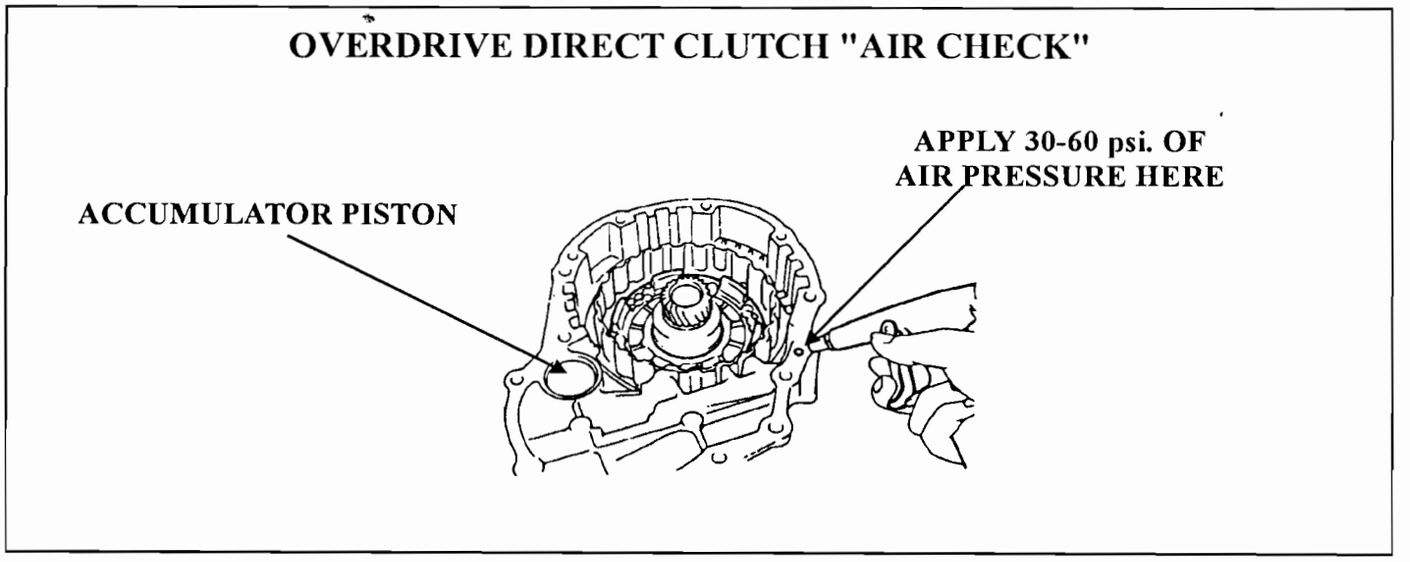



Figure 74

# SUBARU 4 SPEED AUTOMATIC AWD TRANSFER CLUTCH OPERATION

## TIGHT CORNER BRAKING

COMPLAINT: Vehicle exhibits a shuddering or bucking sensation while making a low speed turn.

CAUSE: This experience is commonly referred to as "Tight Corner Braking" and is caused by a malfunction in the ALL WHEEL DRIVE electronically controlled transfer clutch system.
Hydraulically, the transfer clutch, located in the extension housing, (Refer to figure 75) is a stand alone system requiring only a line pressure supply from the transmission control system. The transfer clutch has its own valve body and a normally open pressure control solenoid. The valve body contains a pilot valve which sets the supplied line pressure to a fixed level. It is this pilot oil pressure that the pressure control solenoid "C" is regulating, in relation to duty cycle controlled by the TCM, and sending to the transfer control valve which will control the apply of the transfer clutch so that torque distribution will match vehicle driving conditions (Refer to figure 76).
Duty cycle for the transfer clutch pressure control solenoid is adjusted according to inputs to the TCM. The sensors used are TPS, VSS #1 and #2, Inhibitor Switch, Manual Hold Switch, FWD Switch. The ABS Signal is also used to control transfer clutch torque to reduce engine braking effect on ABS and to also reduce the degree of coupling between the front and rear wheels.
The transfer clutch pressure is also reduced when a low speed turn is being made by the TCM comparing throttle position and the front wheel speed VSS #2) and rear wheel speed (VSS #1) which eliminates the tight corner braking effect.

CORRECTION: When tight corner braking occurs, it usually indicates that the vehicle is in full time four wheel drive.
Follow the steps below to diagnose the transfer clutch control system.

**STEP 1:** Check for trouble codes. Refer to the A.T.S.G. Import Pass Book Vol. 2 For code retrieval procedures, as they vary model to model.

**STEP 2:** Locate the FWD Switch under the hood (Refer to figures 77, 78 and 79) and plug the spare fuse into it. This will turn the transfer clutch off. If tight corner braking still exists, check transfer clutch pressure and voltage (Refer to figure 80).
Voltage is checked between pin 8 and pin 11 on Legacy and Imprezza models, and pin 8 and 12 on XT models. Refer to the chart in figure 81.

**STEP 3:** If voltage and pressure respond to throttle opening as per the chart in figure 80, the transfer clutch may be stuck on due to severe clutch damage.

**STEP 4:** If voltage responds but pressure does not, the problem could be the "C" solenoid is faulty or the transfer control valve is stuck closed.

**STEP 5:** If voltage does not respond to throttle opening, the problem could be a faulty TPS, VSS #1 or #2, or any of the sensors shown in figure 82 or a faulty TCU.

# SUBARU 4 SPEED AUTOMATIC AWD
# TRANSFER CLUTCH OPERATION
## TRANSFER CLUTCH ASSEMBLY

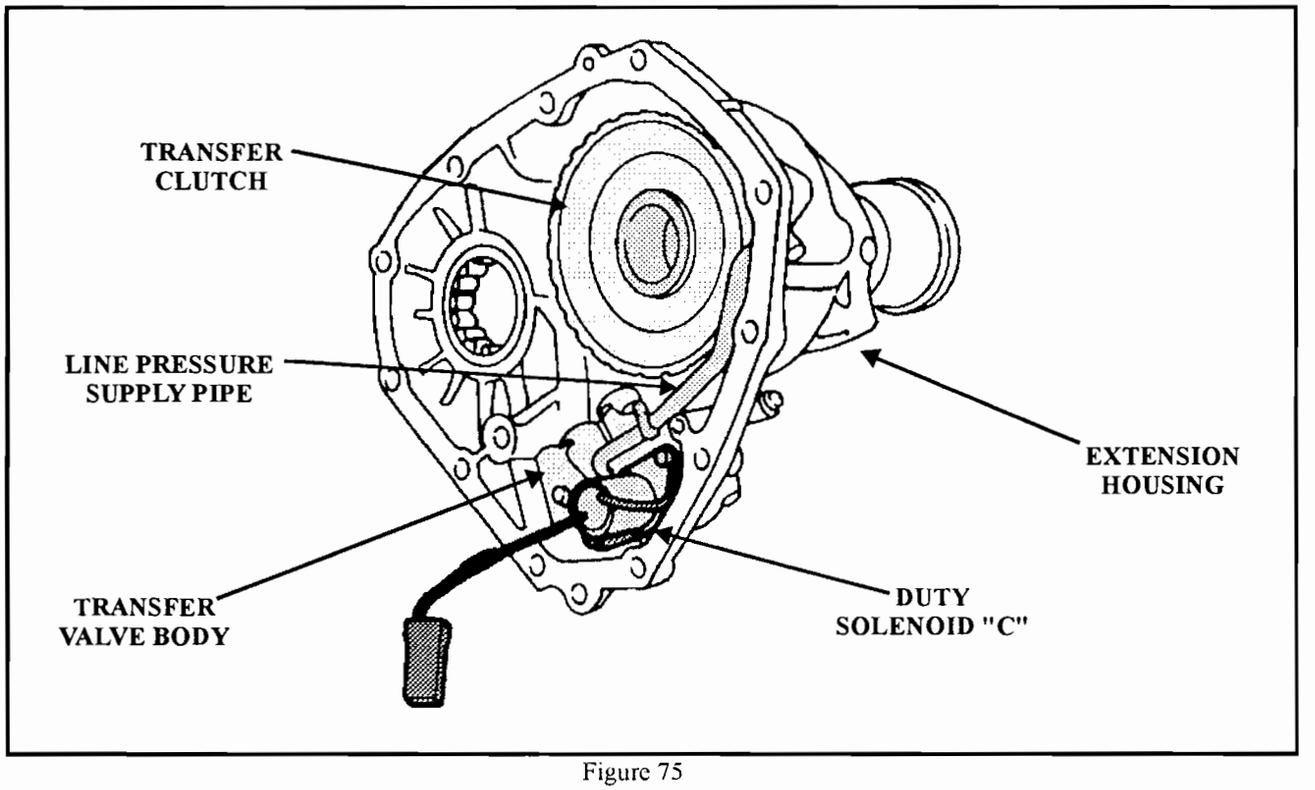



Figure 75

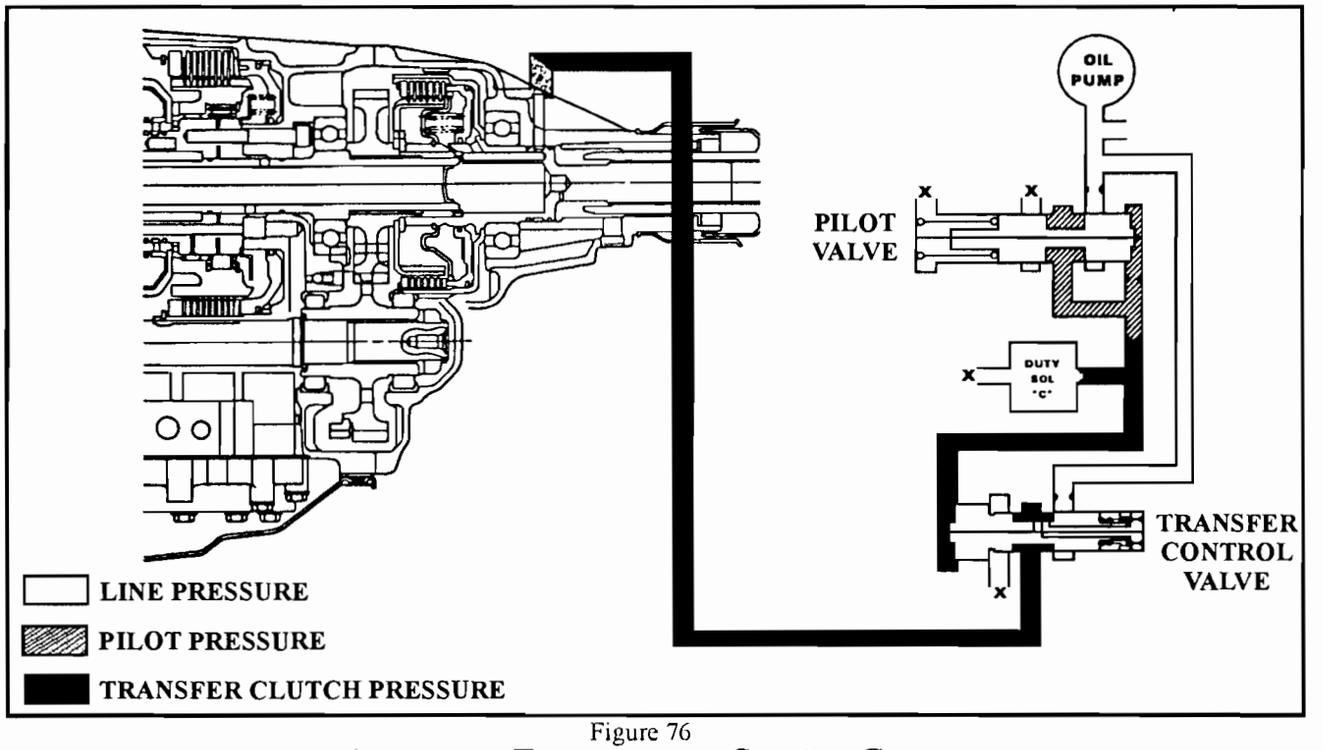



Figure 76

# SUBARU 4 SPEED AUTOMATIC AWD TRANSFER CLUTCH OPERATION

## FRONT WHEEL DRIVE SWITCH

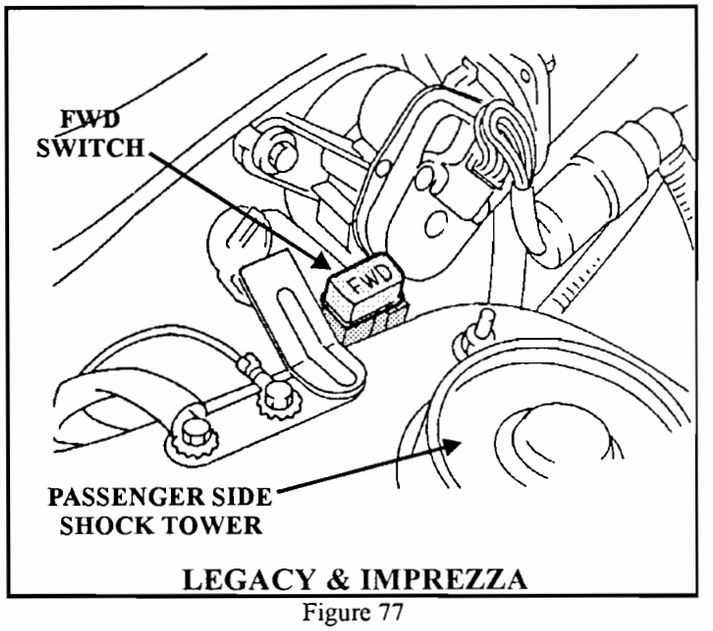


Figure 77

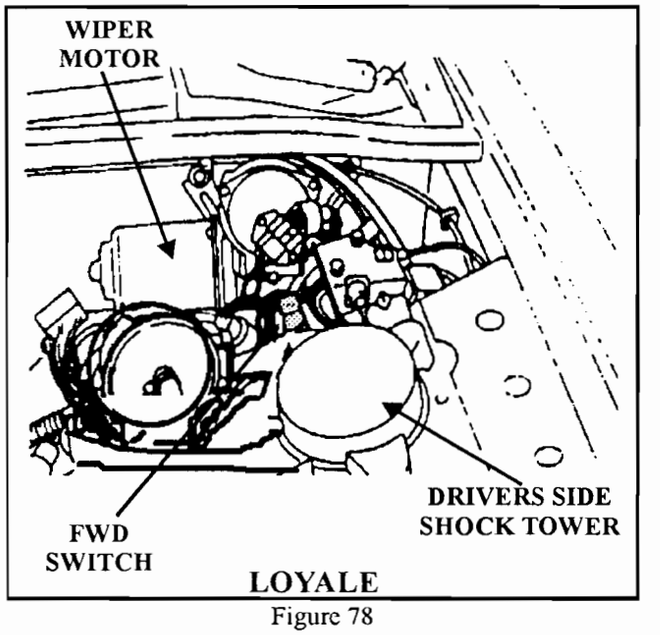


Figure 78

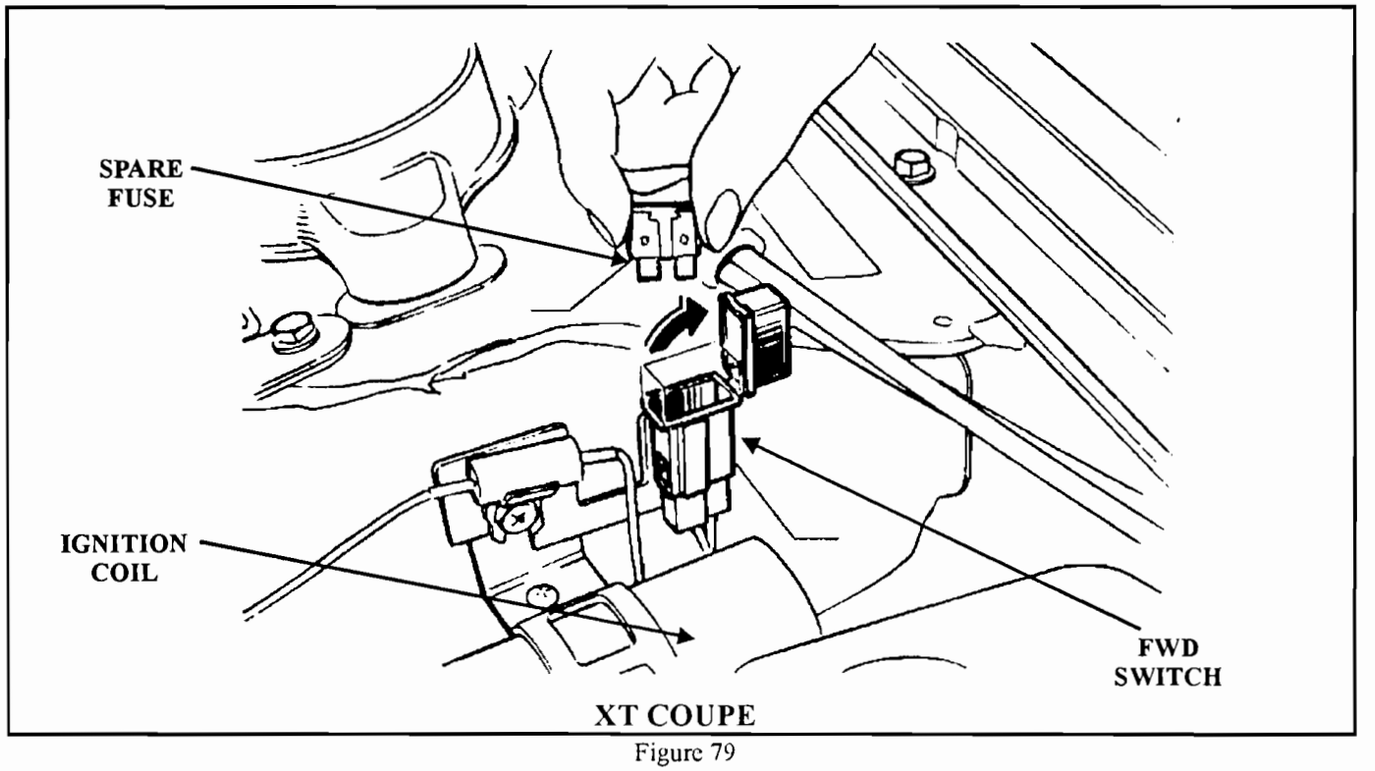


Figure 79

# SUBARU 4 SPEED AUTOMATIC AWD TRANSFER CLUTCH OPERATION

## TRANSFER CLUTCH VOLTAGE AND PRESSURE

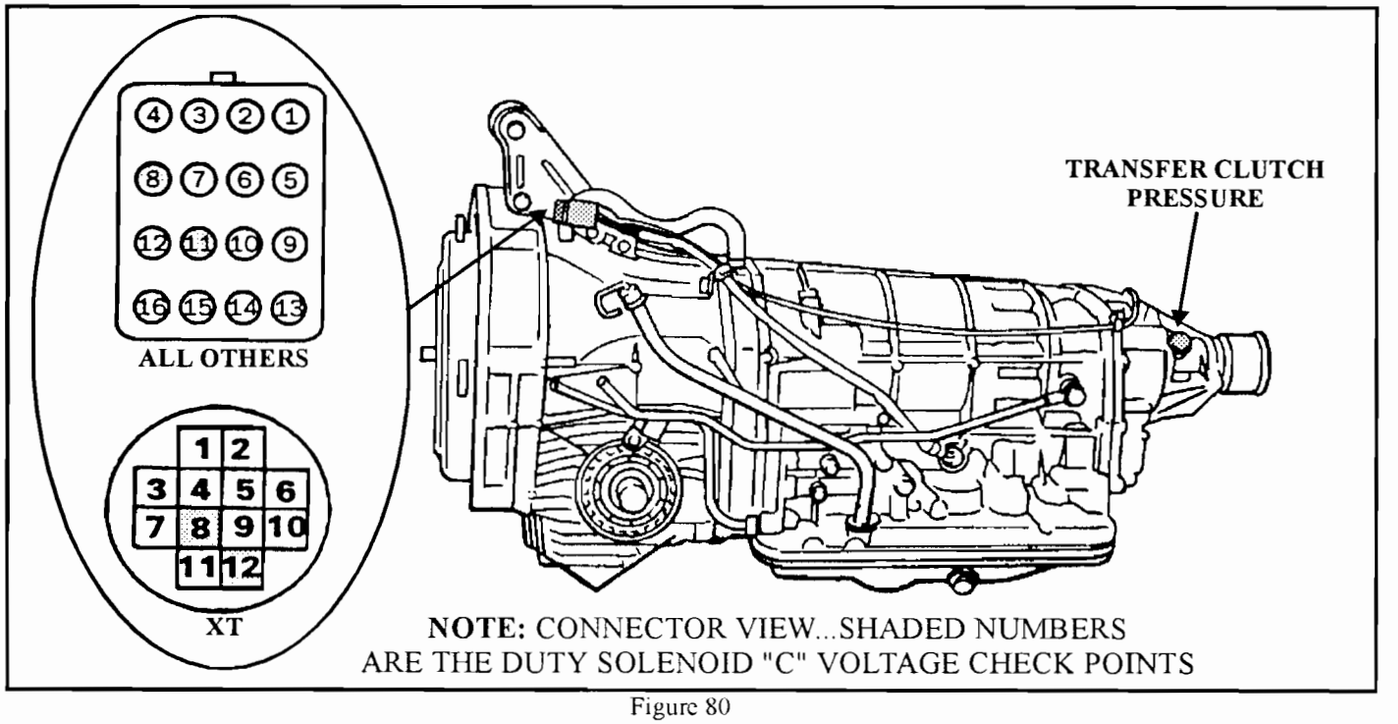



Figure 80

| | FWD fuse not inserted | | FWD fuse inserted | |
|---|---|---|---|---|
| **Selector Lever Position** | **At Idle 600 - 800 rpm** | **Wide Open Throttle stall rpm** | **At Idle 600 - 800 rpm** | **Wide Open Throttle stall rpm** |
| Reverse | 49 - 78 kPa<br>7 - 11 psi | 716 - 785 kPa<br>104 - 114 psi | 0 - 0 kPa<br>0 - 0 psi | 0 - 0 kPa<br>0 - 0 psi |
| Drive | 49 - 78 kPa<br>7 - 11 psi | 716 - 785 kPa<br>104 - 114 psi | 0 - 0 kPa<br>0 - 0 psi | 0 - 0 kPa<br>0 - 0 psi |
| Percentage of Throttle Angle | 0%<br>closed throttle | 100%<br>wide open throttle | 0%<br>closed throttle | 100%<br>wide open throttle |
| Voltage between duty sol. **"C"** and a ground | Engine running approximately<br>8 - 14 volts | Engine running approximately<br>0.5 volts | Engine running approximately<br>12 - 14 volts | Engine running approximately<br>12 - 14 volts |
| Percentage of duty cycle | AWD mode approximately<br>95% | AWD mode approximately<br>25% | FWD mode approximately<br>95% | FWD mode approximately<br>95% |

Figure 81

# SUBARU 4 SPEED AUTOMATIC AWD TRANSFER CLUTCH OPERATION

## TRANSFER CLUTCH CONTROL SYSTEM

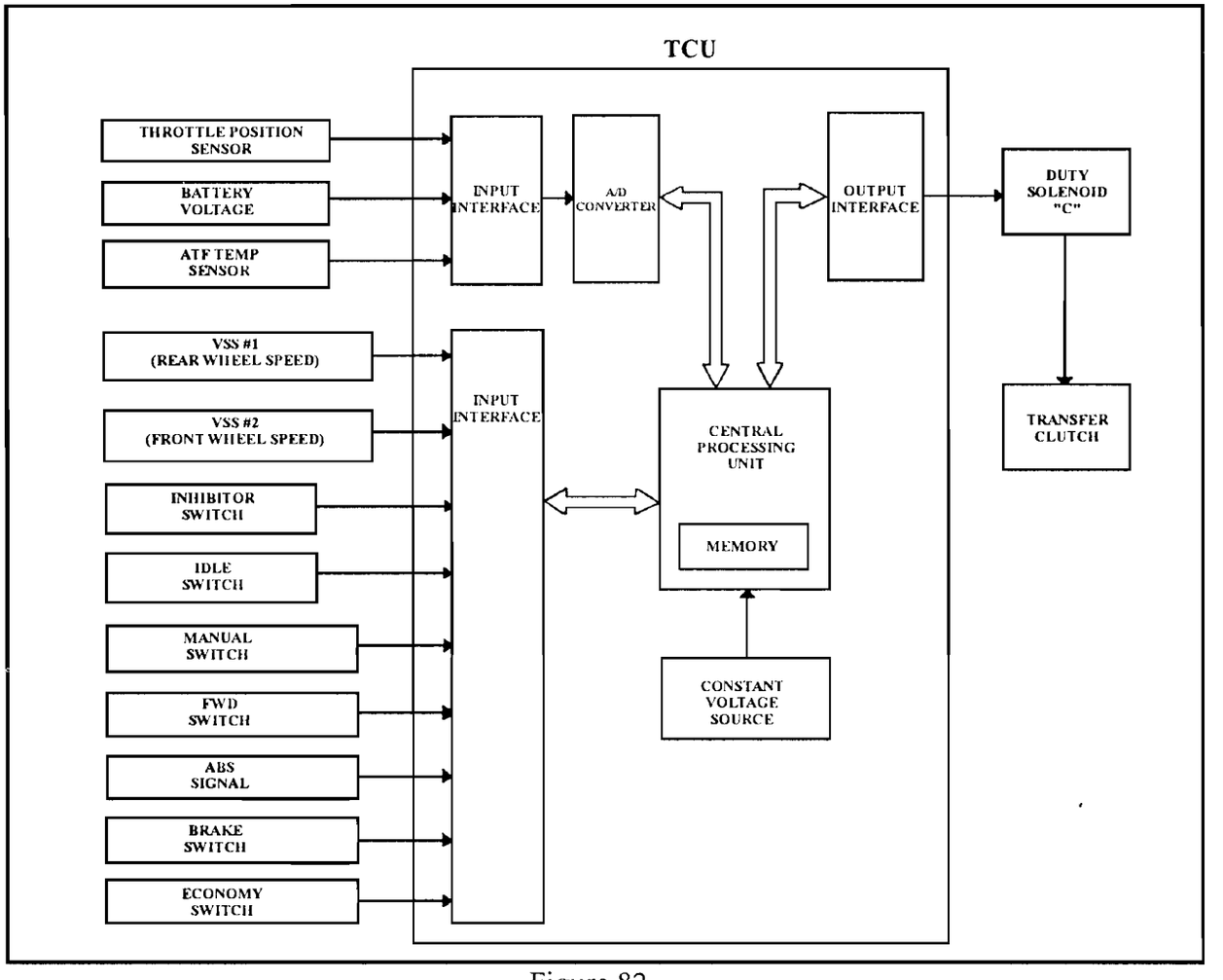



Figure 82

| SENSOR FUNCTION FOR TRANSFER CLUTCH CONTROL | |
|---|---|
| **THROTTLE POSITION SENSOR** | Used to determine duty ratio of solenoid "C". |
| **BATTERY VOLTAGE** | Used for voltage compensation of duty solenoid "C". |
| **ATF TEMP. SENSOR** | Used for temperature compensation of duty solenoid "C". |
| **SPEED SENSOR #1** | Detects rear wheel speed for duty ratio of solenoid "C". |
| **SPEED SENSOR #2** | Detects front wheel speed for comparison to rear wheel speed to control duty ratio for wheel slip and low speed turns. |
| **INHIBITOR SWITCH** | Used for correction of duty ratio setting. |
| **IDLE SWITCH** | Used for duty ratio setting. |
| **FWD SWITCH** | The duty ratio is set at 5% by this signal. |
| **1ST HOLD SWITCH** | Used for setting duty ratio in manual low. |

# SUBARU 4 SPEED AUTOMATIC
## OVERFULL DIFFERENTIAL

COMPLAINT: Differential is overfull with ATF contamination.

CAUSE: If the rubber seal that goes between the differential housing and the oil pump cover (Refer to figure 83) is NOT installed or is mispositioned, automatic transmission fluid will leak from the transmission into the differential area. This will delete the ATF level in the transmission causing it to slip and can also result in fluid leakage out the oil pump housing breather hose. (Refer to figure 84).

CORRECTION: Make certain this seal IS installed and is greased in place to insure it will not move out of position during the assembly process.

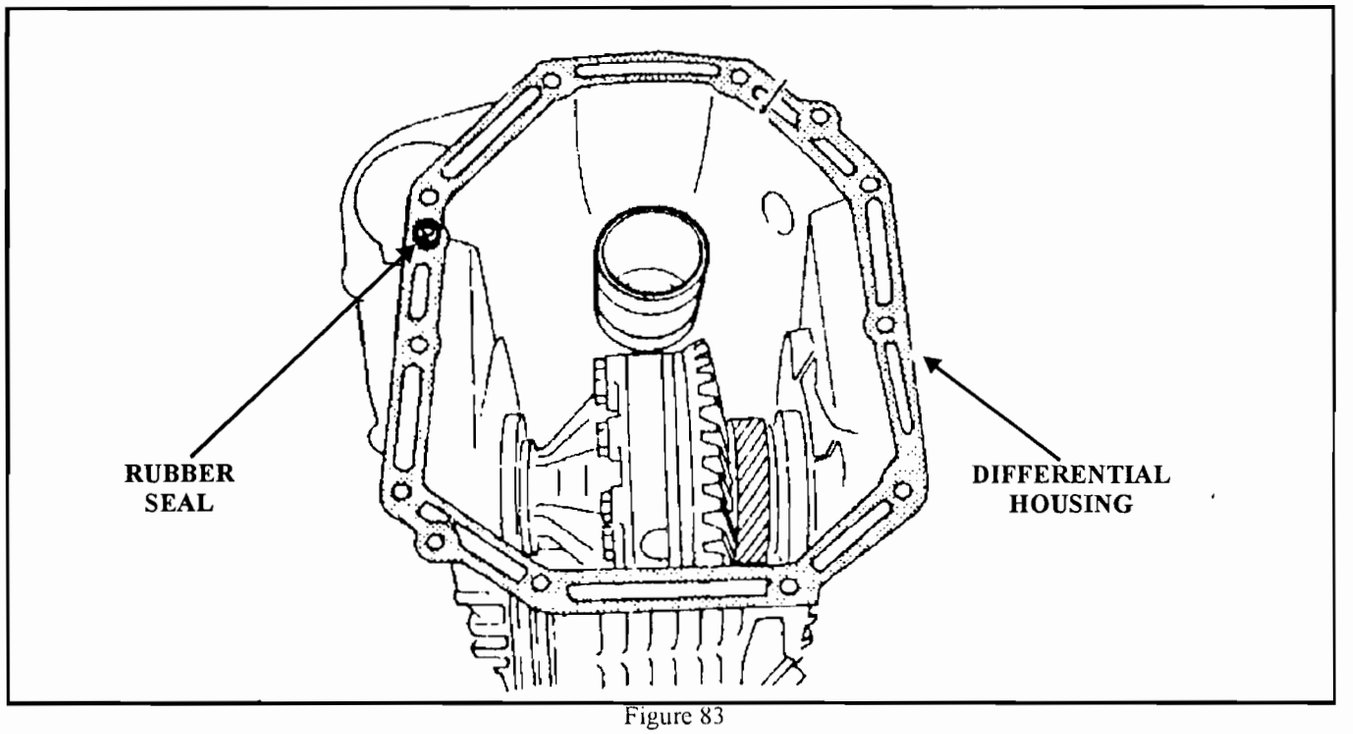



Figure 83

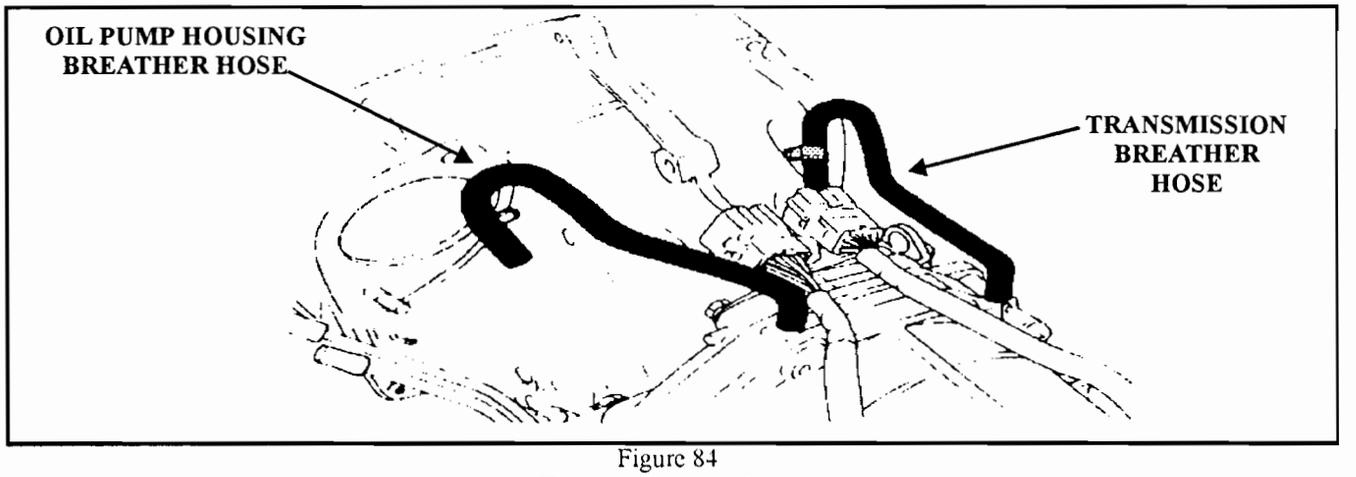
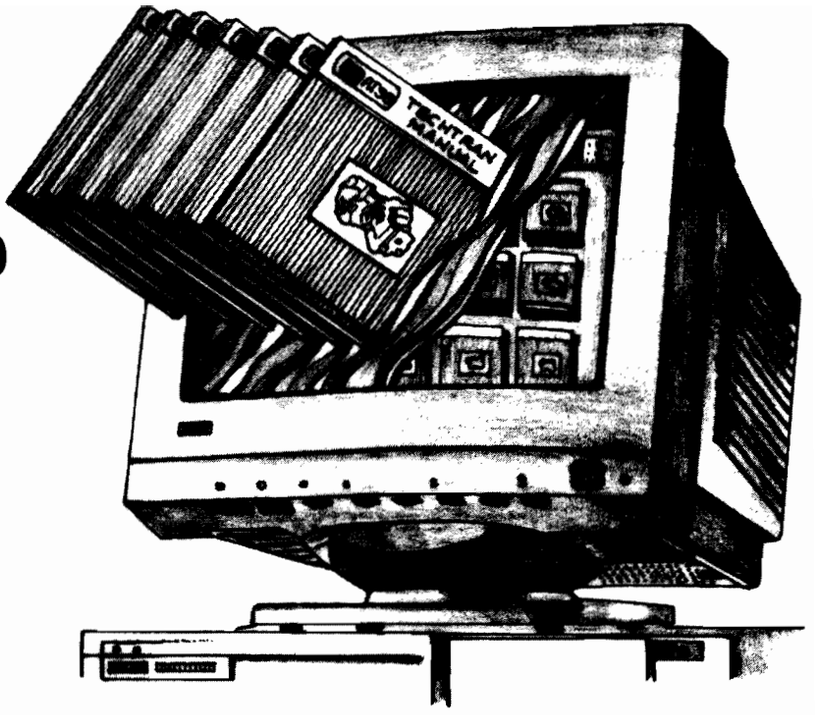



Figure 84

# Another First ...

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# ISUZU TROOPER AND RODEO
## HARSH ENGAGEMENTS AND OR HARSH SHIFTING
## CODE 32 OR 33 STORED

**COMPLAINT:** Vehicle comes into the shop with the "check trans" light flashing on the dash accompanied by harsh engagements and/or harsh shifting. After checking for codes, the computer indicates that a code 32 or 33 has been set.

**CAUSE:** The most common causes for this problem is either a faulty variable force solenoid, an electrical problem between the TCM and the solenoid, or a faulty computer. Other causes may be connected to a bad battery, an alternator that is over charging the system, or bad grounds. Code 32 will be set if the computer detects a current draw of less than 95 milliamps (0.095 amps) between terminals 40 and 41 of the TCM. Code 33 will be set if the computer detects a current draw greater than 1.5 amps between terminals 40 and 41 of the TCM. In either case when an electrical failure is detected and the code is set, the TCM will turn off power to the variable force solenoid which raises line pressure to its maximum causing the harsh engagements and harsh shifting.

**CORRECTION:** FOR CODE 32:

To correct this problem a complete electrical check of the variable force solenoid circuit will be necessary.

**STEP 1:** Using a DVOM set the meter to DC volts, and place the positive lead of the meter to the positive terminal of the vehicle battery. Next place the negative lead of the meter to the negative terminal on the battery. Measure the voltage across both terminals, the voltage reading should be approximately 12.6 volts. If the voltage reading is not correct, replace the battery.

**STEP 2:** With the voltmeter still connected to the battery start the vehicle. The voltage reading should now be approximately 13.0 to 14.0 volts. Watch the voltmeter for any signs of a voltage spike. If a voltage spike occurs when the vehicle is started, the alternator may be faulty and will need to be checked. Next place the negative lead of the meter on the battery negative terminal, place the positive lead of the meter on the body of the vehicle. The meter should read 0.10 volts or less with the ignition switch "ON". If the reading is not correct, the vehicle ground circuit will need to be checked.

**STEP 3:** Turn the vehicle ignition switch to "OFF". Go to the TCM and disconnect the harness connector. Using an ohmmeter place the leads of the meter across pins 40 and 41 of the TCM harness connector going to the transmission (See Figures 86 and 87). Resistance should be between 3.7 and 4.7 ohms. **(If resistance is "OK", proceed with this step, if resistance is not "OK" go to step 4)**. If resistance is "OK", check for a faulty TCM connector. If the TCM connector is "OK", replace the TCM clear the code and recheck.

# ISUZU TROOPER AND RODEO
## HARSH ENGAGEMENTS AND OR HARSH SHIFTING
## CODE 32 OR 33 STORED

**STEP 4:** If the resistance between pins 40 and 41 of the TCM connector is not between 3.7 and 4.7 ohms, place the meter leads between pin 40 of the TCM connector and a good ground. No continuity should exist. If no continuity exists, place the meter leads between pin 41 of the TCM connector and a good ground. No continuity should exist. **(If no continuity exists on either wire, proceed to step 5)**. If continuity exists between pin 40 and ground, there is a short to ground on that wire between the TCM and the variable force solenoid. If continuity exists between pin 41 and ground, there is a short to ground on that wire between the TCM and the variable force solenoid. Fix the short to ground on the proper wire, or run a new wire, clear the code and recheck.

**STEP 5:** If no continuity exists between pin 40 and ground and pin 41 and ground, disconnect the solenoid connector at the adaptor housing. Using a meter check for continuity between pin 40 at the TCM connector and pin 2B at the solenoid harness (See Figure 86 and 87). Continuity should exist. Next, check for continuity between pin 41 at the TCM connector and pin 1E at the solenoid harness. Continuity should exist. **(If continuity exists on both wires, go to step 6)**. If continuity does not exist at both wires, fix the open in the proper wire, or run a new wire, clear the code and recheck.

**STEP 6:** With the solenoid harness still disconnected at the transmission, use an ohmmeter and check the resistance between pins 2B and 1E at the female side of the transmission case connector (See Figure 86). The resistance should be between 3.7 and 4.7 ohms. **(If the resistance is correct go to step 7)**. If the resistance is not correct remove the oil pan on the adaptor housing and disconnect the wires from the solenoid (See Figure 86). Using a meter place the leads across both terminals and check for resistance. Resistance should be between 3.7 and 4.7 ohms. If resistance is not correct replace the solenoid, clear the code and recheck.

**STEP 7:** If the resistance check at the solenoid is between 3.7 and 4.7 ohms, there is a bad connection between the solenoid harness connector and the transmission case connector. Fix or replace the proper connector, clear the code and recheck.

# ISUZU TROOPER AND RODEO
## HARSH ENGAGEMENTS AND OR HARSH SHIFTING
## CODE 32 OR 33 STORED

**CORRECTION:** FOR CODE 33:

Code 33 is set when the TCM detects a current draw that is greater than 1.5 amps between terminals 40 and 41 of the TCM. When this code is set, the TCM will turn off power to the variable force solenoid which raises line pressure to maximum. To properly diagnose and correct this problem, it will be necessary to perform a complete electrical check of the variable force solenoid circuit.

**STEP 1:** Using a DVOM set the meter to DC volts, and place the positive lead of the meter to the positive terminal of the vehicle battery. Next place the negative lead of the meter to the negative terminal on the battery. Measure the voltage across both terminals. The voltage reading should be approximately 12.6 volts. If the voltage reading is not correct, replace the battery.

**STEP 2:** With the voltmeter still connected to the battery start the vehicle. The voltage reading should now be between 13.0 and 14.0 volts. Watch the voltmeter for any signs of a voltage spike. If a voltage spike occurs when the vehicle is started, the alternator may be faulty and will need to be checked. Next place the negative lead of the meter on the battery negative terminal. Place the positive lead of the meter on the body of the vehicle. The meter should read 0.10 volts or less with the ignition switch in the "ON" position. If the voltage reading is not correct, the vehicle ground circuit will need to be checked.

**STEP 3:** Turn the vehicle ignition switch to "OFF". Go to the TCM and disconnect the harness connector. Using an ohmmeter place the leads of the meter across pins 40 and 41 of the TCM harness connector going to the transmission (See Figure 87). Resistance should be between 3.7 and 4.7 ohms. **(If resistance is correct, proceed with this step. If resistance is incorrect go to step 4)**. If the resistance is correct, check for a faulty TCM connector. If the TCM connector is "OK", replace the TCM clear the code and recheck.

**STEP 4:** If the resistance between pins 40 and 41 of the TCM connector is not between 3.7 and 4.7 ohms, place the meter leads between pin 40 of the TCM connector and a good ground. No continuity should exist. Next place the meter leads between pin 41 of the TCM connector and a good ground. No continuity should exist. **(If no continuity exists on either wire, proceed to step 5)**. If continuity exists between pin 40 and ground, there is a short to power on the wire between the TCM and the variable force solenoid. If continuity exists between pin 41 and ground, there is a short to power on the wire between the TCM and the variable force solenoid. Fix the short to power on the proper wire or run a new wire, clear the code and recheck.

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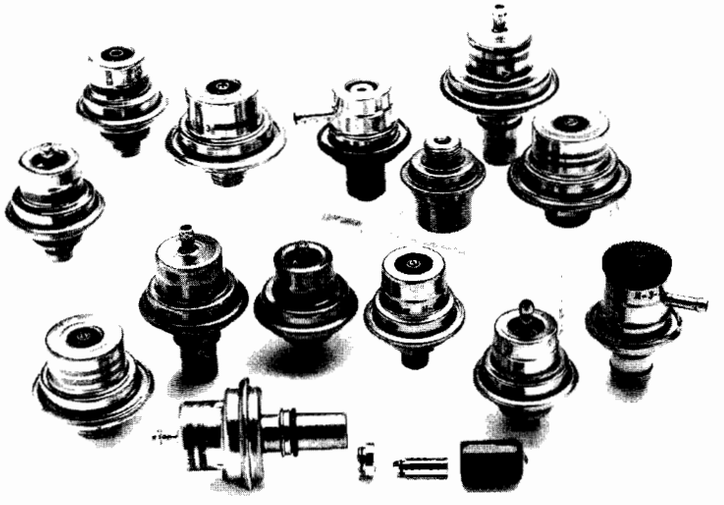

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# ISUZU TROOPER AND RODEO
## HARSH ENGAGEMENTS AND OR HARSH SHIFTING
## CODE 32 OR 33 STORED

**STEP 5:** If no continuity exists between pin 40 and ground and pin 41 and ground, disconnect the solenoid connector at the adaptor housing. Using a meter check for continuity between pin 40 at the TCM connector and pin 2B at the solenoid harness Continuity should exist. Next, check for continuity between pin 41 at the TCM connector and pin 1E at the solenoid harness. Continuity should exist. **(If continuity exists on both wires, go to step 6)**. If continuity does not exist at both wires, ix the open in the proper wire, clear the code and recheck.

**STEP 6:** With the solenoid harness still disconnected at the transmission, use an ohmmeter and check the resistance between pins 2B and 1E at the female side of the transmission case connector. The resistance should be between 3.7 and 4.7 ohms. **(If the resistance is correct go to step 7)**. If the resistance is not correct remove the oil pan on the adaptor housing and disconnect the wires from the solenoid (See Figure 86). Using a meter place the leads across both terminals and check for resistance Resistance should be between 3.76 and 4.7 ohms. If resistance is not correct replace the solenoid, clear the code and recheck.

**STEP 7:** If the resistance check at the solenoid is between 3.7 and 4.7 ohms, there is a bad connection between the solenoid harness connector and the transmission case connector. Fix or replace the proper connector, clear the code and recheck.

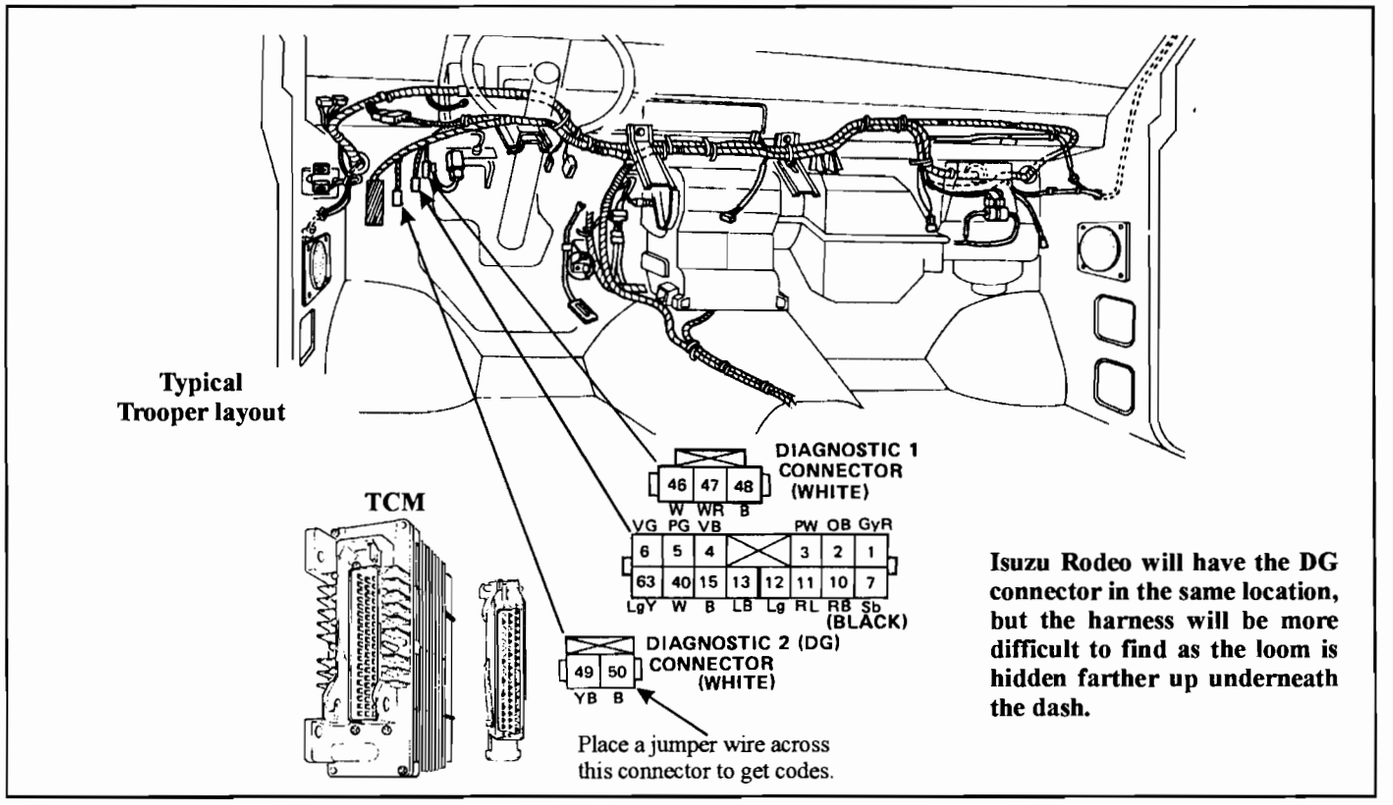



Figure 85

# ISUZU TROOPER AND RODEO
## HARSH ENGAGEMENTS AND OR HARSH SHIFTING
## CODE 32 OR 33 STORED

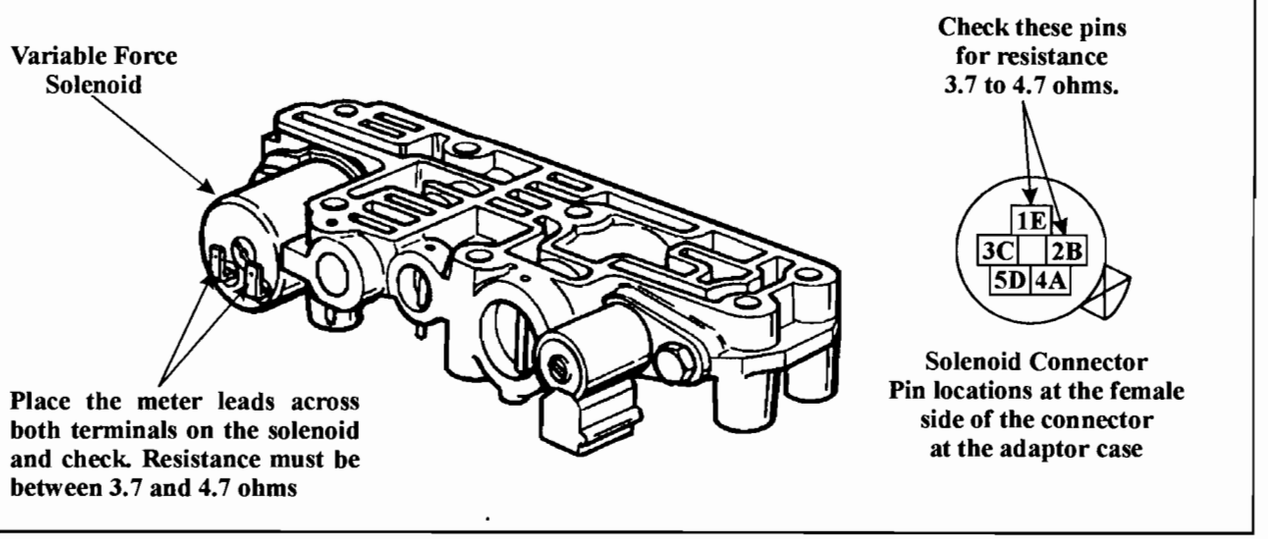
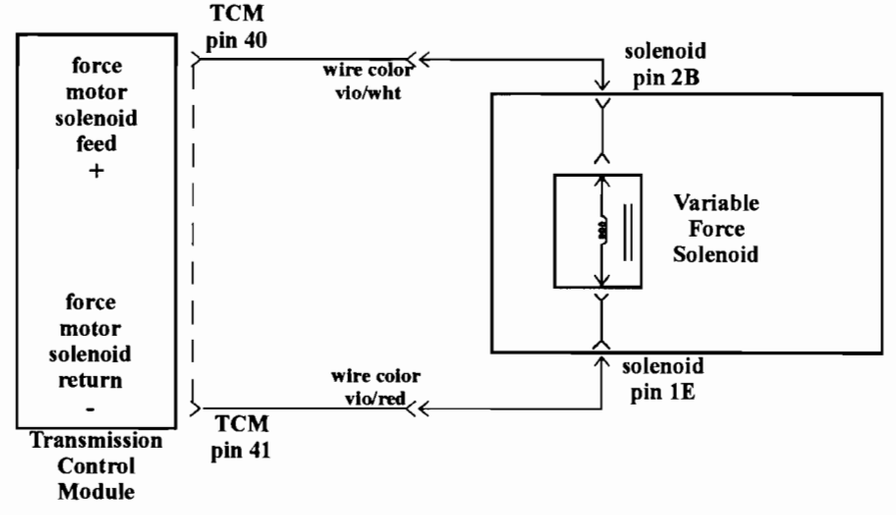



Figure 86



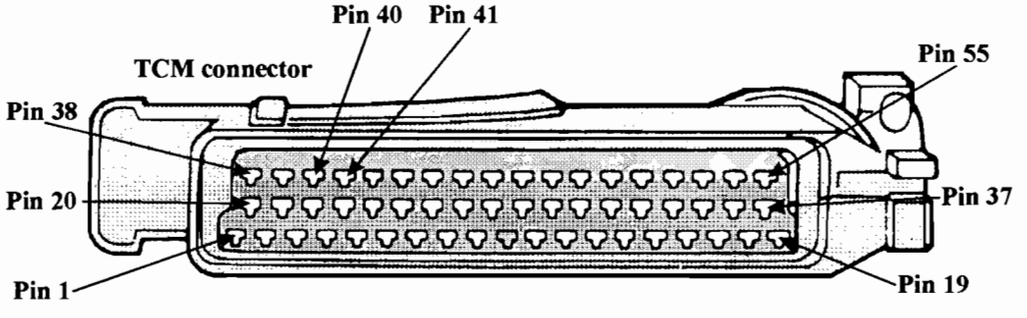
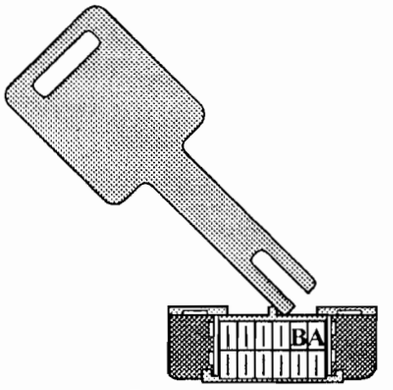




Figure 87

# SATURN TAAT
## ACTUATORS AUDIBLE QUICK CHECK

An Audible quick check of the actuators can be easily performed to determine if the electrical system from the PCM to the actuator is in good working order. The proper procedure in the performance of this test is to first verify with a scanner that the Selector Lever Switch is working correctly. In other words, when you are in Park the scanner shows the letter P and so on. The next step is to remove the scanner from the Data Link Connector and jump terminal A to B in the connector as shown in Figure 1. After the terminals have been jumped, turn the ignition to the "ON" position. Do not start the engine. Next, move the selector lever into the manual 2 position and listen for a buzzing noise coming from the 2nd actuator. Use the chart in Figure 2 which illustrates the gear selector position to check the desired actuator.



Data Link Connector

Figure 1

| GEAR SELECTION | ACTUATOR |
|---|---|
| 2 | 2nd Actuator |
| 3 | 3rd Actuator |
| D | 4th Actuator |
| R | TCC Actuator |
| N | Line Actuator |

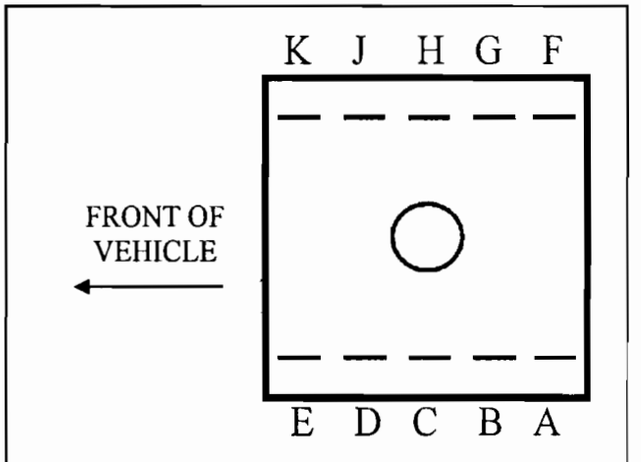
Figure 2

# SATURN TAAT
## ERRATIC SHIFT COMPLAINT

Complaint: After the replacement of new actuators, the vehicle experiences erratic shifts. Codes for the actuators may or may not be set.

Cause: The wrong design actuators were installed. All 1991 and 1992 actuators measure approximately 2.5 to 4.5 ohms while all 1993 and up actuators measure 4.0 to 6.0 ohms. These actuators will not interchange.

Correction: Install the correct design actuators. Verify actuator resistances through the connector using a DVOM set to ohms. Figure 3 provides a view of the actuator connector with each terminal identified. Each actuator has its own positive and negative terminals as shown in Figure 3. When checking each actuator, refer to the chart in Figure 4 for the resistance values.
NOTE:The chart in Figure 4 provides the acceptable resistance tolerances based on temperature and the year of the vehiclel. All actuators should be within 1 ohm of each other. Also Saturn color coded the actuators as well to assist in preventing the installation of the wrong actuators. BLACK and BLUE Actuators are used in 1991 and 1992 vehicles. 1993 and up use RED Actuators. At the time of this printing, the part number for the 1991 and 1992 actuator is 21002248. 1993 and up actuators are under the part number 21002509.




| Actuator | Terminal + | Terminal - |
|---|---|---|
| 2nd | J | H |
| 3rd | A | B |
| 4th | C | D |
| TCC | E | K |
| Line | G | F |

Figure 3

| *Temperature* | | *Resistance (Ohms)* | |
|---|---|---|---|
| Degrees F | Degrees C | 1991-1992 | 1993 & up |
| -40 | -40 | 2.2 | 3.4 |
| 68 | 20 | 3 | 4.5 |
| 122 | 50 | 3.5 | 5.0 |
| 176 | 80 | 4 | 5.5 |
| 230 | 110 | 4.5 | 6.0 |

Figure 4

# SATURN TAAT
## DESIGN LEVELS

CHANGE: During the production year of April 1992, design changes were made to the transaxle in all SL1, SL2 Sedans and SC Coupes with VIN NZ00001 through NZ200100 (Trial Run), and all vehicles built from and including NZ205625. Changes were made to the case, FWD/REV servo piston and spring, the valve body, spacer plate, manual valve, gaskets and the PCM.

REASON: These changes were implemented to prohibit the movement of the Forward/Reverse servo piston toward reverse if the vehicle is traveling forward greater than 3 mph. This is accomplished by controlling oil flow to the FWD/REV servo piston which operates the dog clutch. The oil is controlled to the servo by the addition of a servo apply valve.

PARTS AFFECTED:

(1) VALVE BODY:

The valve body has been completely redesigned. Major changes include the elimination of the TCC enable valve, actuator feed mode valve, and the line boost plunger. The spacer plate and gaskets have also been redesigned along with the manual valve. A servo apply valve has been added to the valve body in the 2nd design (See Figures 5-8).

**TCC Enable Valve** - The torque converter clutch enable valve has been eliminated in the new design. This valve was used primarily to disable TCC when in P, N, manual D2 and 1st gear. By disabling the TCC in these quadrants, the vehicle can still be driven forward if the TCC actuator was stuck "ON". Logic has been added to the new design PCM to detect a stuck "ON" condition, so the TCC valve is no longer required.

**Actuator Feed Mode Valve** - The actuator feed mode valve has also been eliminated to simplify the system. The elimination of this valve will only have an affect when certain conditions are detected by the PCM. On transaxles built before this change, if a certain condition exists, the PCM will detect the condition and illuminate the "SHIFT TO D2" lamp. When the driver selects manual D2, the system will go to boost pressure and allow a 2nd gear start. When selecting D2 on the new system, the vehicle may start out in any forward gear depending on the failure condition.

**Line Boost Plunger** - D2 boost oil is no longer used which eliminated the use of a line boost plunger located in the pressure regulator valve. This caused a redesign to the line pressure control plunger. Line pressure is now totally controlled by the PCM, line actuator and the line pressure regulator.

**Servo Apply Valve** - The servo apply valve, located in the valvebody is used to control reverse apply oil to the forward/reverse servo piston. When reverse is selected, the manual valve will allow oil to be applied to the servo apply valve. If vehicle speed input to the PCM indicates the vehicle is less than 8 km/h (5 mph), then the dog clutch can be moved to the reverse direction without causing damage. With vehicle speed less than 8 km/h (5 mph), and reverse selected, the PCM will command high-line pressure. When high-line pressure is commanded, the pressure will move the servo apply valve against the spring which opens up the passage allowing oil to pass through the servo apply valve to the forward/reverse servo piston. If reverse is selected when vehicle speed is greater then 8 km/h (5 mph), the PCM will command low-line pressure causing the servo apply spring to keep the passage in the servo apply valve closed, preventing oil to reach the forward/reverse servo piston. This action does not allow the dog clutch to move, thus preventing internal damage to the transaxle.

PARTS AFFECTED Continued:

(2) SPACER PLATE AND GASKETS:
The spacer plate and spacer plate gaskets are redesigned to accommodate the new valvebody. The 1992 2nd design parts will contain an idetification mark as shown in Figure 9.

(3) FWD/REV SERVO AND SPRING:
In addition to the servo valvepreviously described, the forward/reverse servo piston and spring have been redesigned. The main difference in the new piston is that the step and a hole in the shaft have been eliminated. Also, the spring in the new design is longer. Figures 9 and 10 show the differences.

(4) MANUAL VALVE:
Due to valvebody changes, the manual valve has also been redesigned for directing oil to the proper hydraulic circuits. The new manual valve is illustrated in Figure 11. IMPORTANT: When installing the 2nd designed manual valve, the notch must be facing up. The new valve will have a slot instead of a flat near the end which connects the valve to the linkage. In 1994, this manual valve underwent another change. A plastic cap was placed onto the valve to prevent the manual valve from being incorrectly installed (See Figure 11). With the second design change to the manual valve came a redesign of the manual valve link as shown in Figure 12.

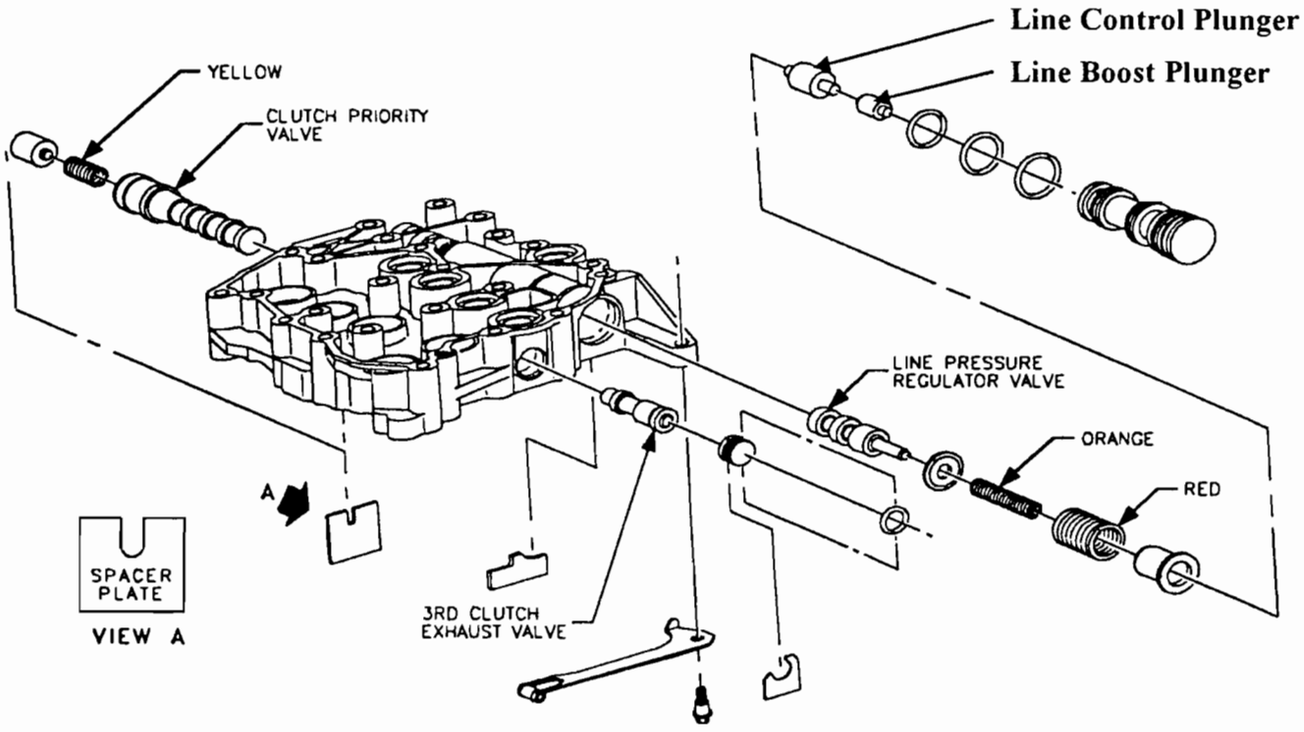
(5) CASE ASSEMBLY:
Due to the elimination of the step in the forward/reverse servo piston, the case has been redesigned to accommodate the removal of this step (See Figures 13 and 14). IMPORTANT: The new case can be identified by a "SV," located on the casting below the case-to-cradle mount holes.

(6) POWERTRAIN CONTROL MODULE:
In addition to changes in the transaxle, there are changes in the PCM which make a new PCM a requirement. The new PCM cannot be used on previous models. The logic for preventing dog clutch engagement when the vehicle speed is present has been added, and the most noticeable change is that under certain drive/idle conditions, low-line pressure or high pressure line will be commanded. This change will eliminate the actuator buzzing noise detected while at idle and when the transaxle is in drive.

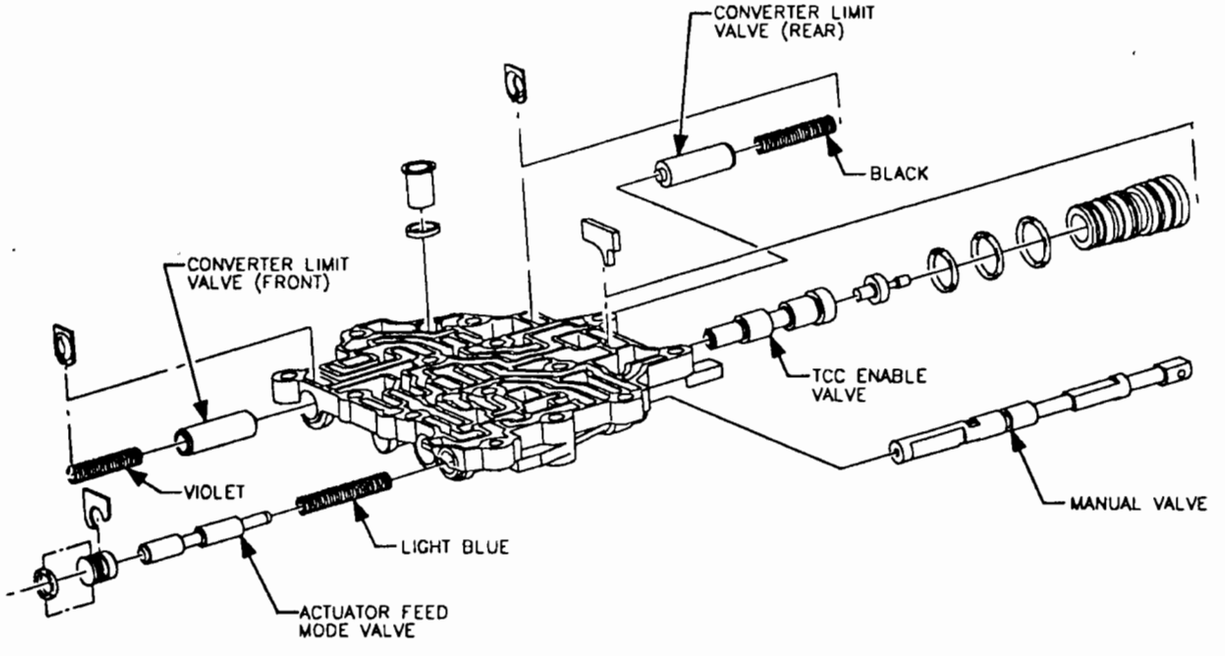
INTERCHANGEABILITY:
The parts listed in this bulletin are not interchangeable between 1st and 2nd design.

SERVICE INFORMATION:

| Part | 1991 and 1992 1st Design | 1992 2nd Design |
|---|---|---|
| Valve Body | 21002273 | 21002691 |
| Manual Valve | 21001539 | 21002695 |
| FWD/REV Servo | 21002552 | 21002547 |
| FWD/REV Servo Spring | 21002553 | 21002626 |
| Case | 21002449 | 21002622 |
| Spacer Plate Gaskets | 21002527 | 21002390 |
| Spacer Plate | 21002410 | 21002389 |
| PCM Base Auto (LKO) | 21021221 (91)<br>21021469 (92) | 21022078 |
| PCM PERF Auto (LLO) | 21021220 (91)<br>21021470 (92) | 21022079 |

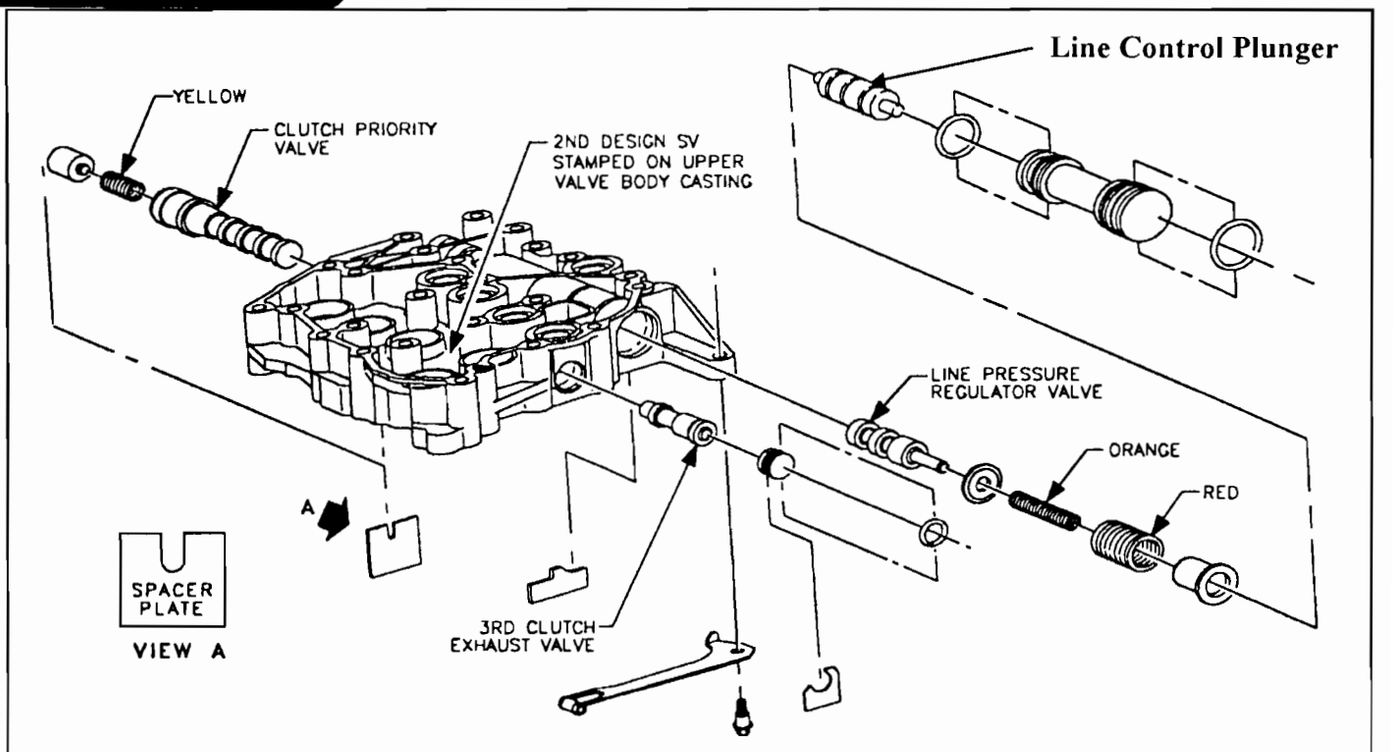



*FIRST DESIGN UPPER VALVE BODY*

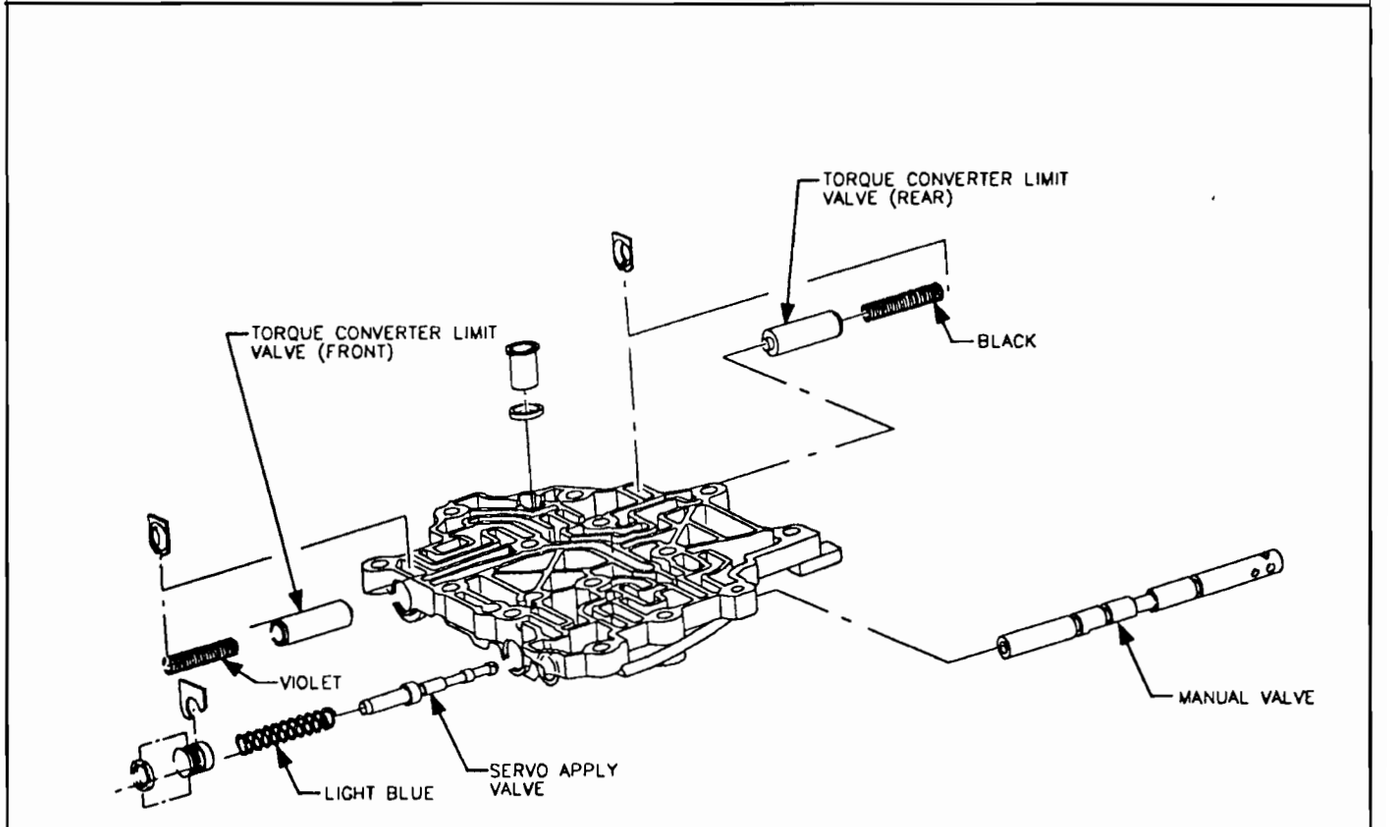



*FIRST DESIGN LOWER VALVE BODY*

Figure 5




*SECOND DESIGN UPPER VALVE BODY*




*SECOND DESIGN LOWER VALVE BODY*

Figure 6
*Automatic Transmission Service Group*

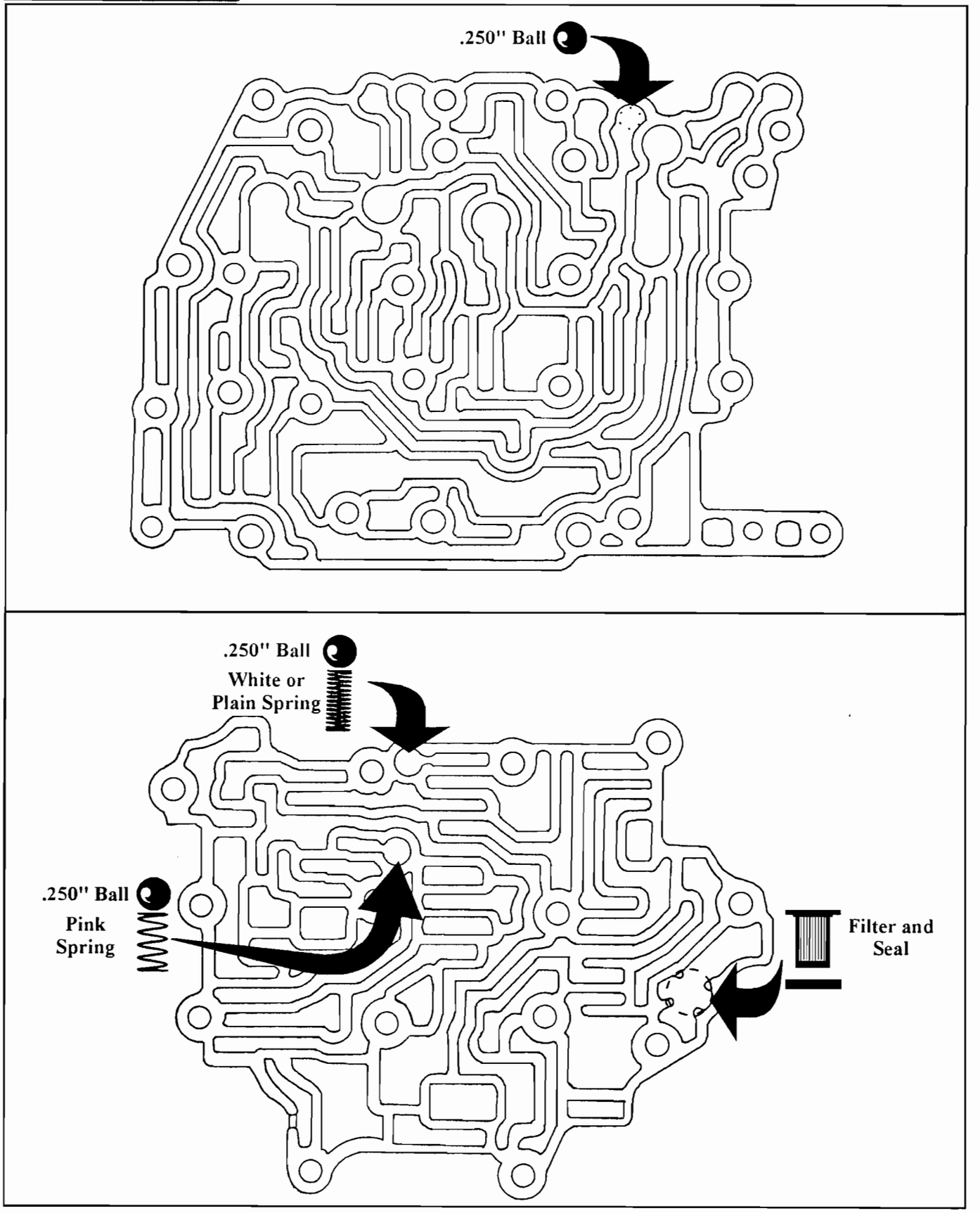

.250" Ball
.250" Ball
White or
Plain Spring
.250" Ball
Pink
Spring
Filter and
Seal

Figure 7

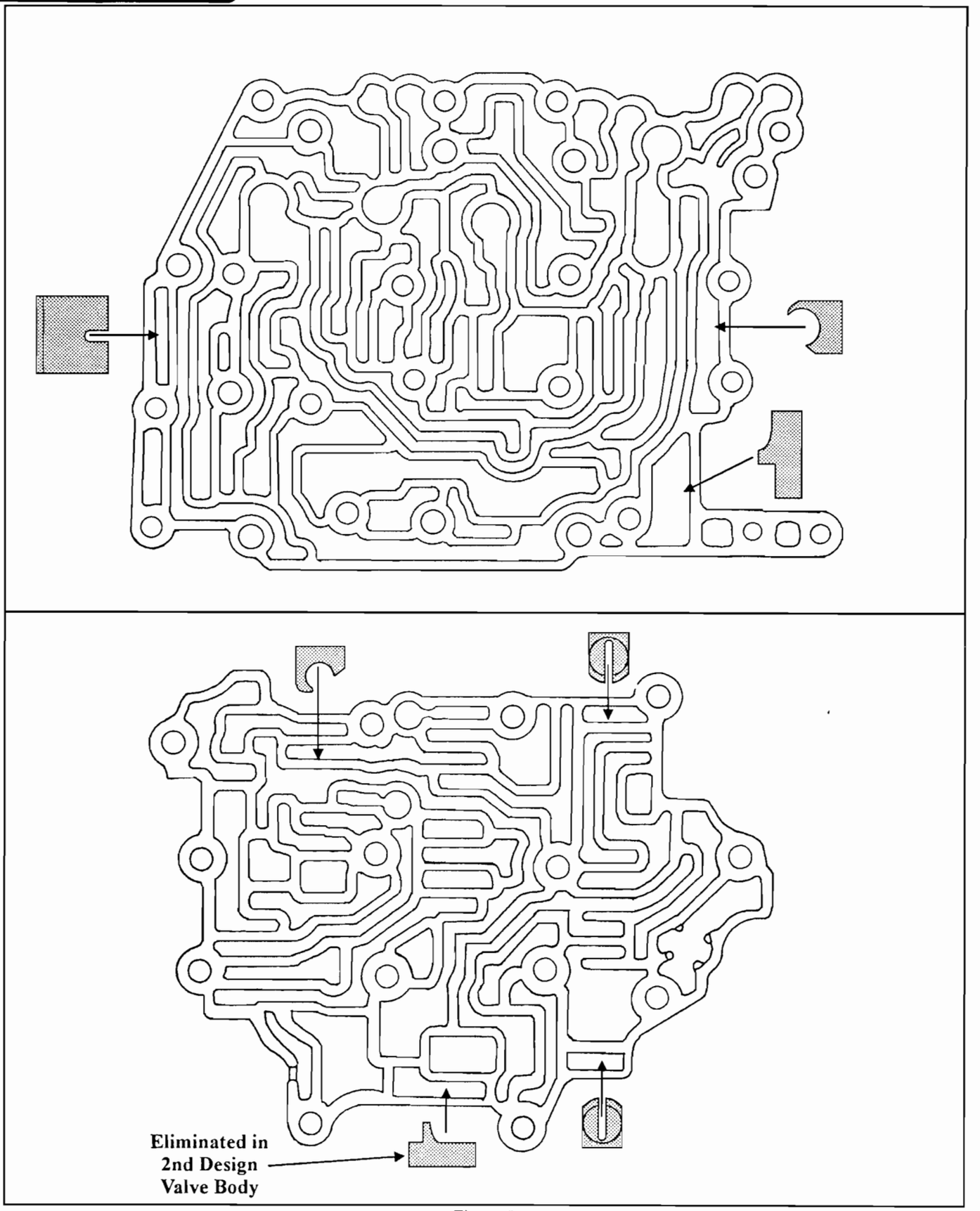
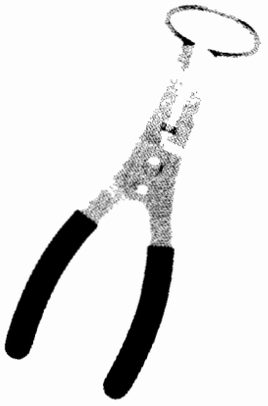
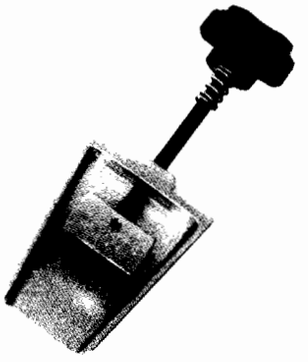



Figure 8
*Automatic Transmission Service Group*

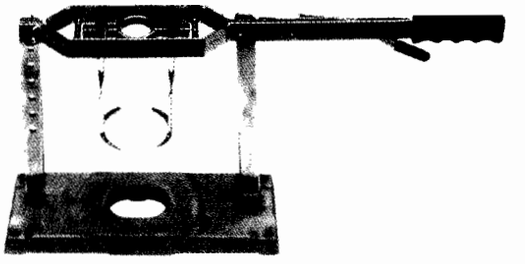
# DEMAND THE BEST



**T-0025-A**
**RINGLOC SNAP RING PLIERS**

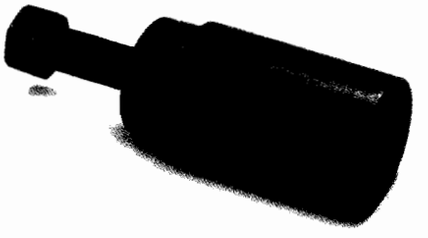


**T-1703**
**FRONT PUMP SPRING LOADER TOOL FOR GM 700R4, 2004R AND 440-T4**

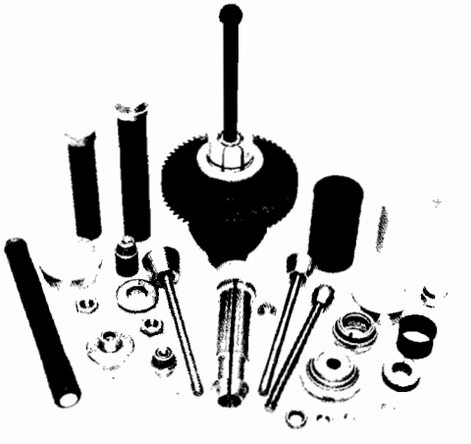


**T-0158-SP**
**SNAPRESS CLUTCH SPRING COMPRESSOR**

**T-0157**
**QUICK LOCK SPRING COMPRESSOR**



**T-1571**
**GM 700-R4 DAMAGED SUN GEAR PULLER**



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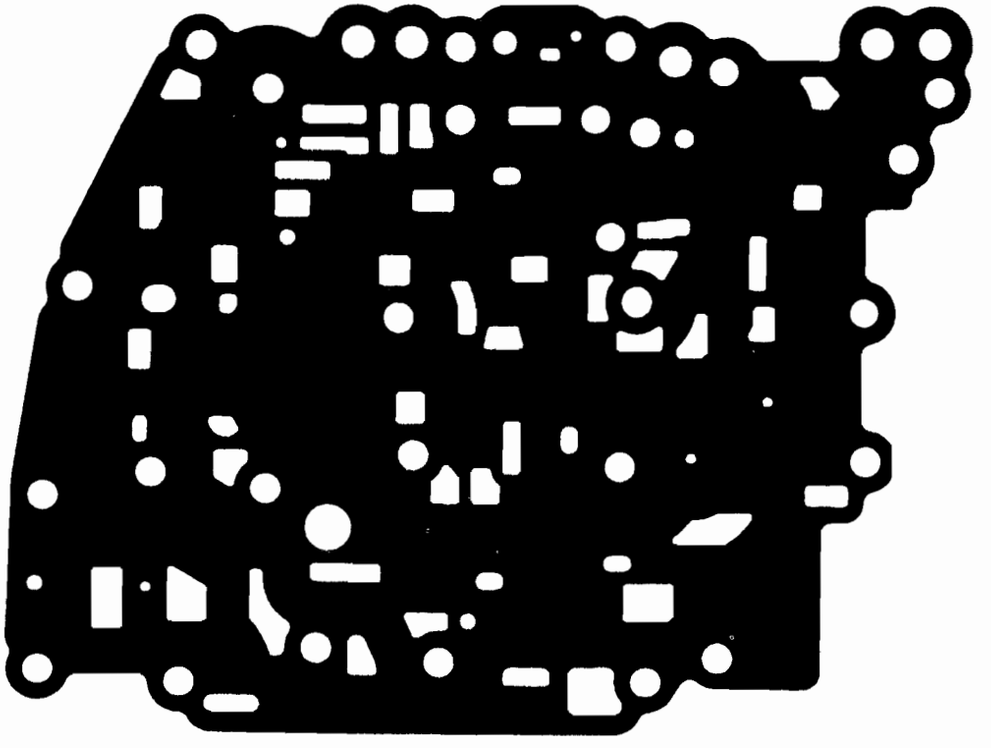
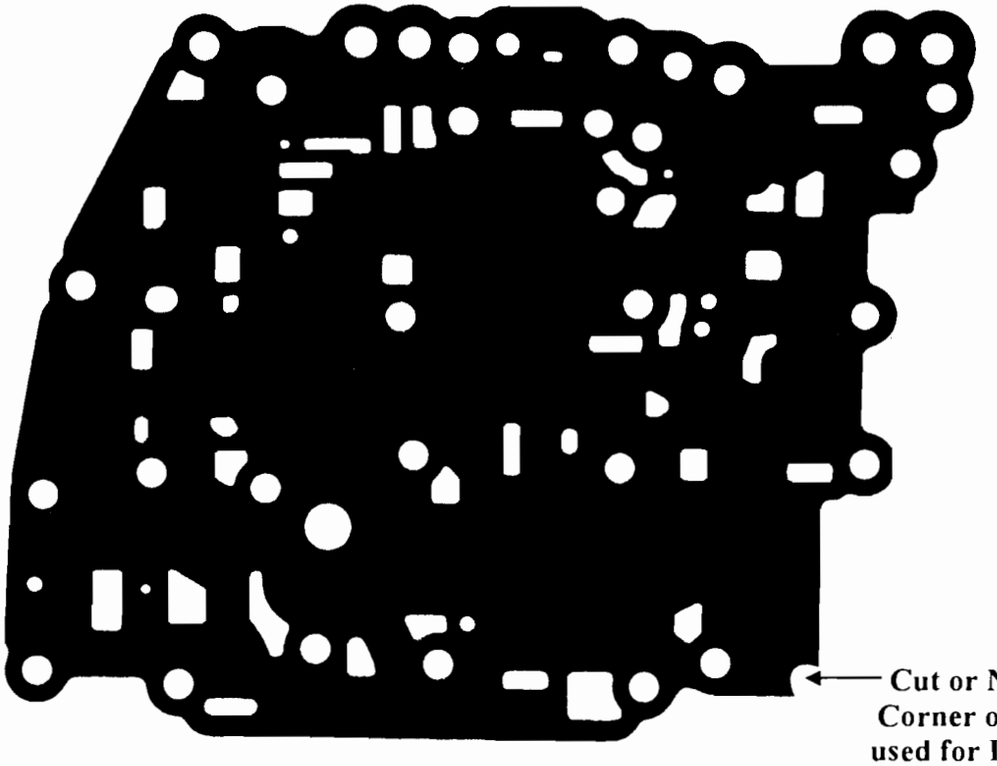


*FIRST DESIGN VALVE BODY GASKET*




*SECOND DESIGN VALVE BODY GASKET*

Figure 9

*Automatic Transmission Service Group*

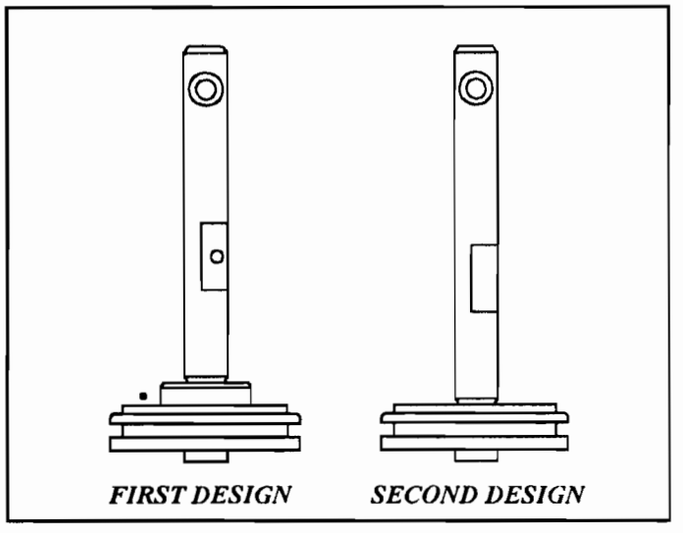



Figure 10

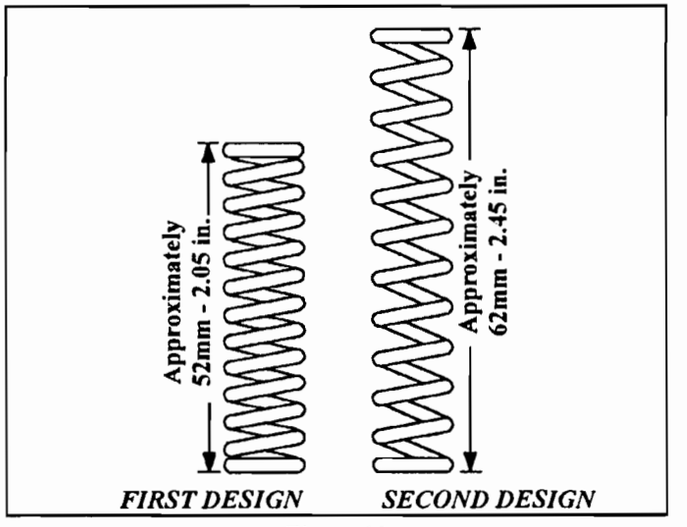



Figure 11

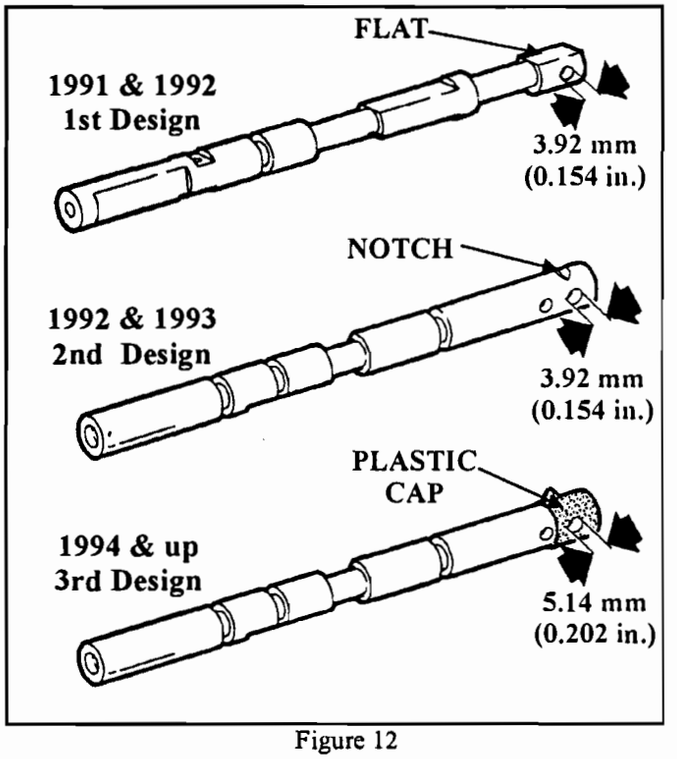



Figure 12

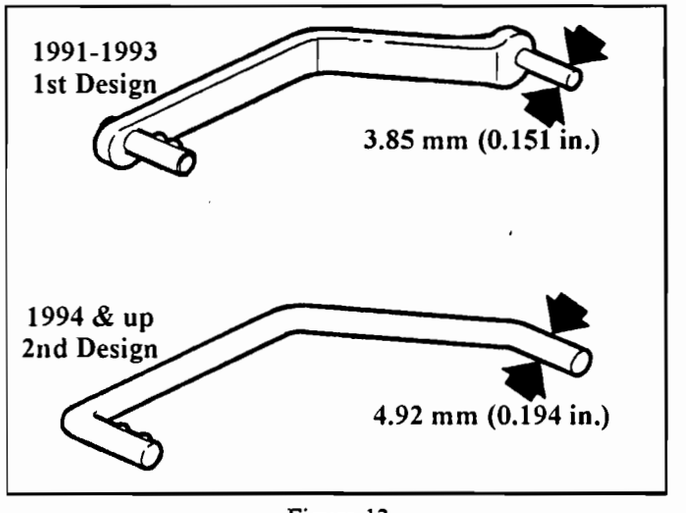



Figure 13

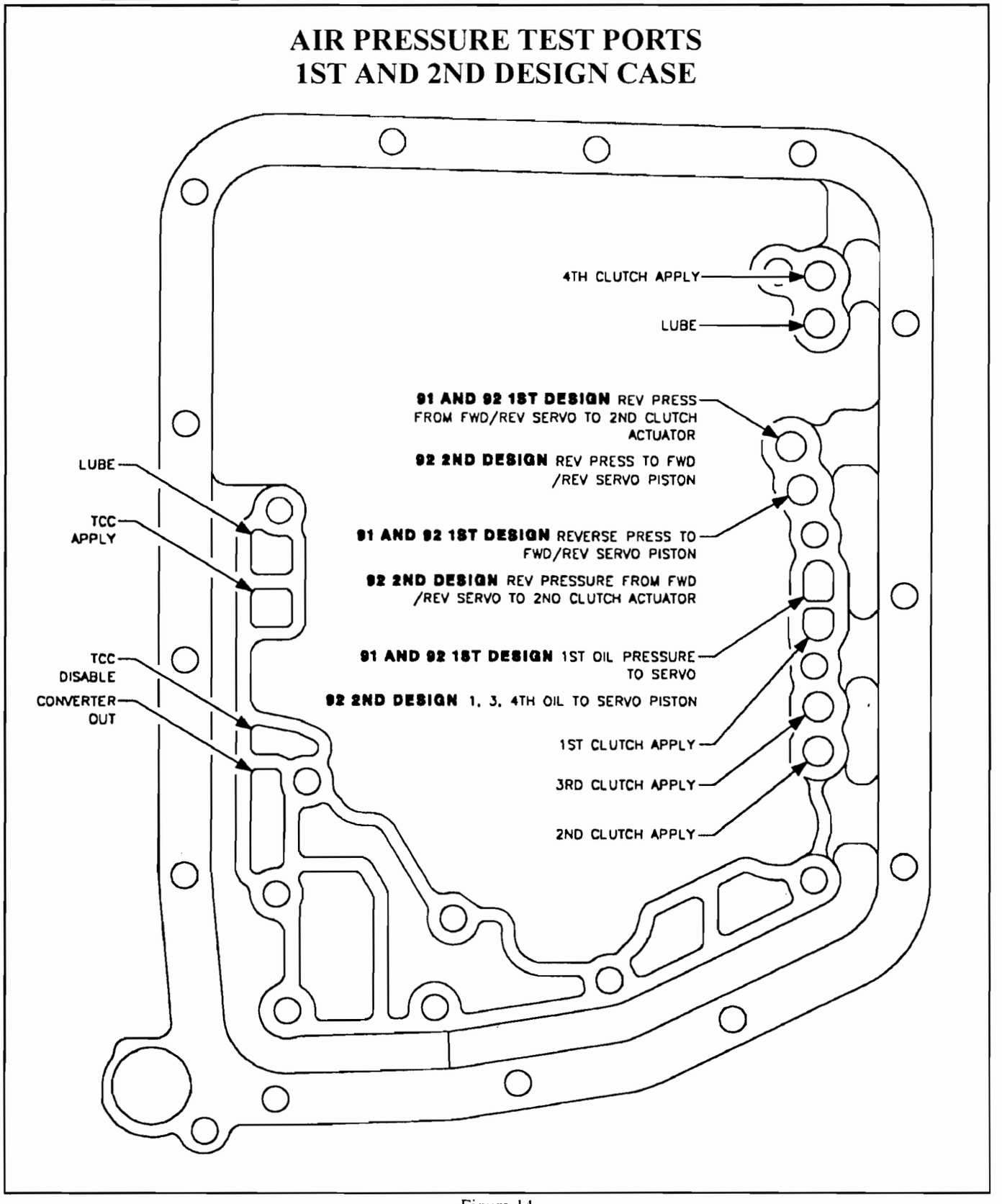
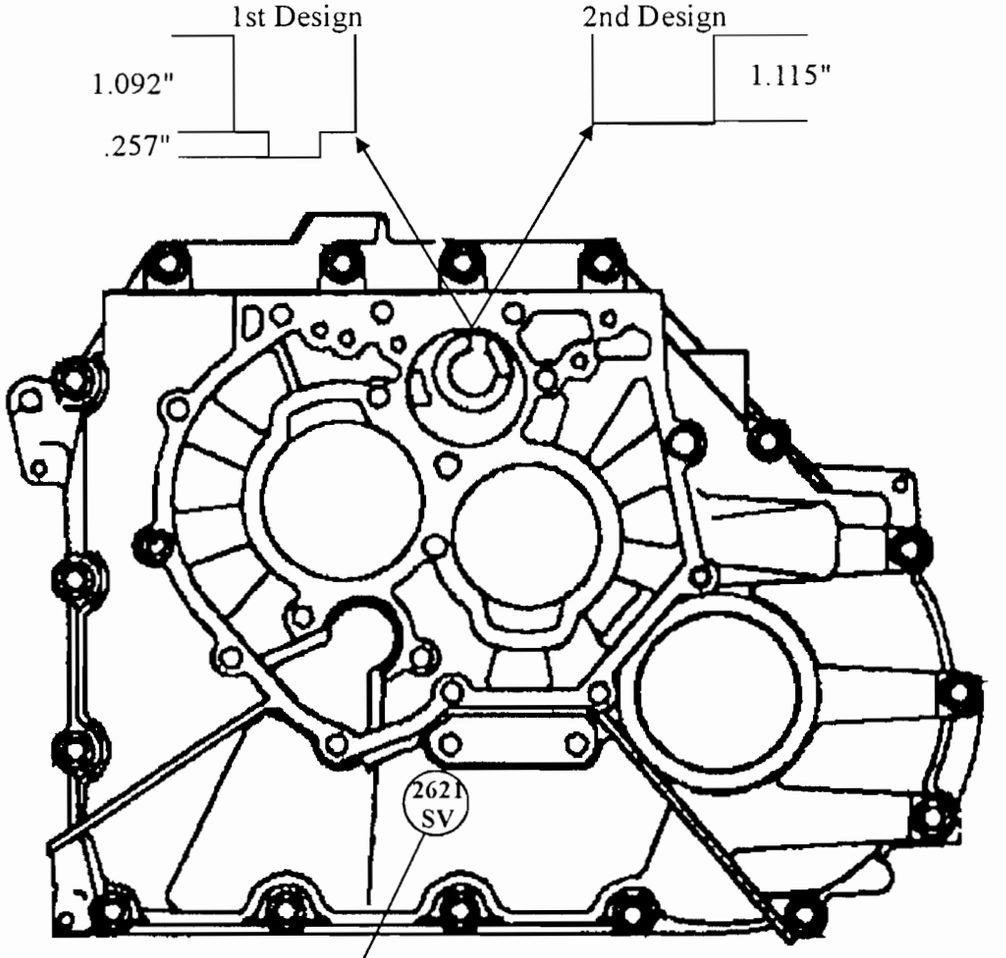

AIR PRESSURE TEST PORTS
1ST AND 2ND DESIGN CASE
4TH CLUTCH APPLY
LUBE
91 AND 92 1ST DESIGN REV PRESS FROM FWD/REV SERVO TO 2ND CLUTCH ACTUATOR
92 2ND DESIGN REV PRESS TO FWD /REV SERVO PISTON
LUBE
TCC APPLY
91 AND 92 1ST DESIGN REVERSE PRESS TO FWD/REV SERVO PISTON
92 2ND DESIGN REV PRESSURE FROM FWD /REV SERVO TO 2ND CLUTCH ACTUATOR
TCC DISABLE
CONVERTER OUT
91 AND 92 1ST DESIGN 1ST OIL PRESSURE TO SERVO
92 2ND DESIGN 1, 3, 4TH OIL TO SERVO PISTON
1ST CLUTCH APPLY
3RD CLUTCH APPLY
2ND CLUTCH APPLY

Figure 14

## CASE IDENTIFICATION




*Identification "SV" for 2nd design case.*

Figure 15

# SATURN TAAT
## GRIND GOING INTO REVERSE OR DRIVE

Complaint: After overhaul, the transaxle may experience a grinding noise during reverse and/or reverse to drive engagements.

Cause: One cause may be the incorrect assembly of the dog clutch hub and sleeve.

Correction: Install the Forward/Reverse dog clutch hub with the wide slots facing the 2nd driven gear. Install the dog clutch sleeve with the identification groove towards the Reverse driven gear (See Figure. 16).

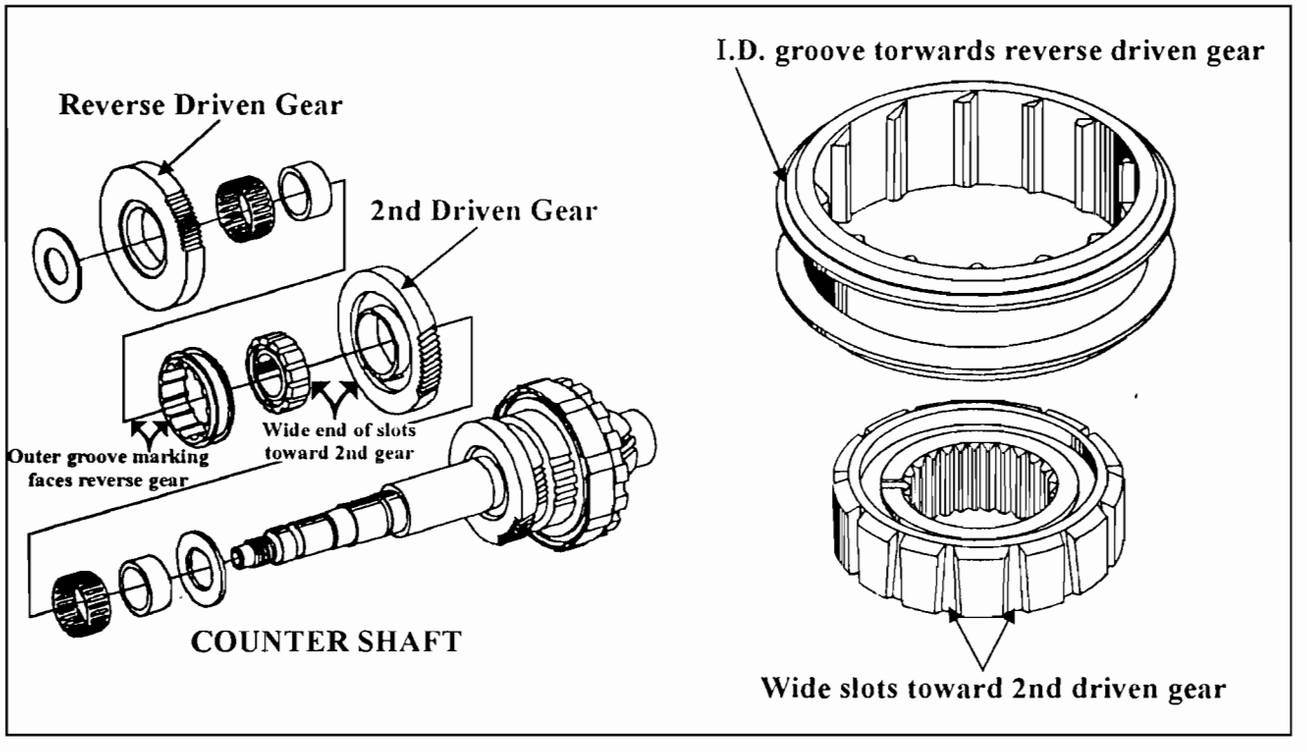



Figure 16

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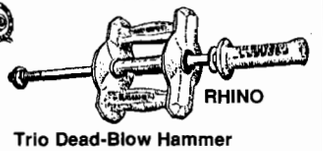


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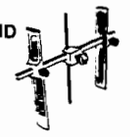
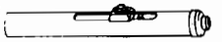


**E-Z UNIVERSAL SPEEDOMETER GEAR INSTALLER**



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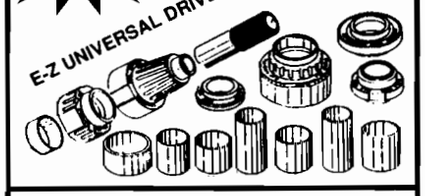

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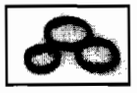

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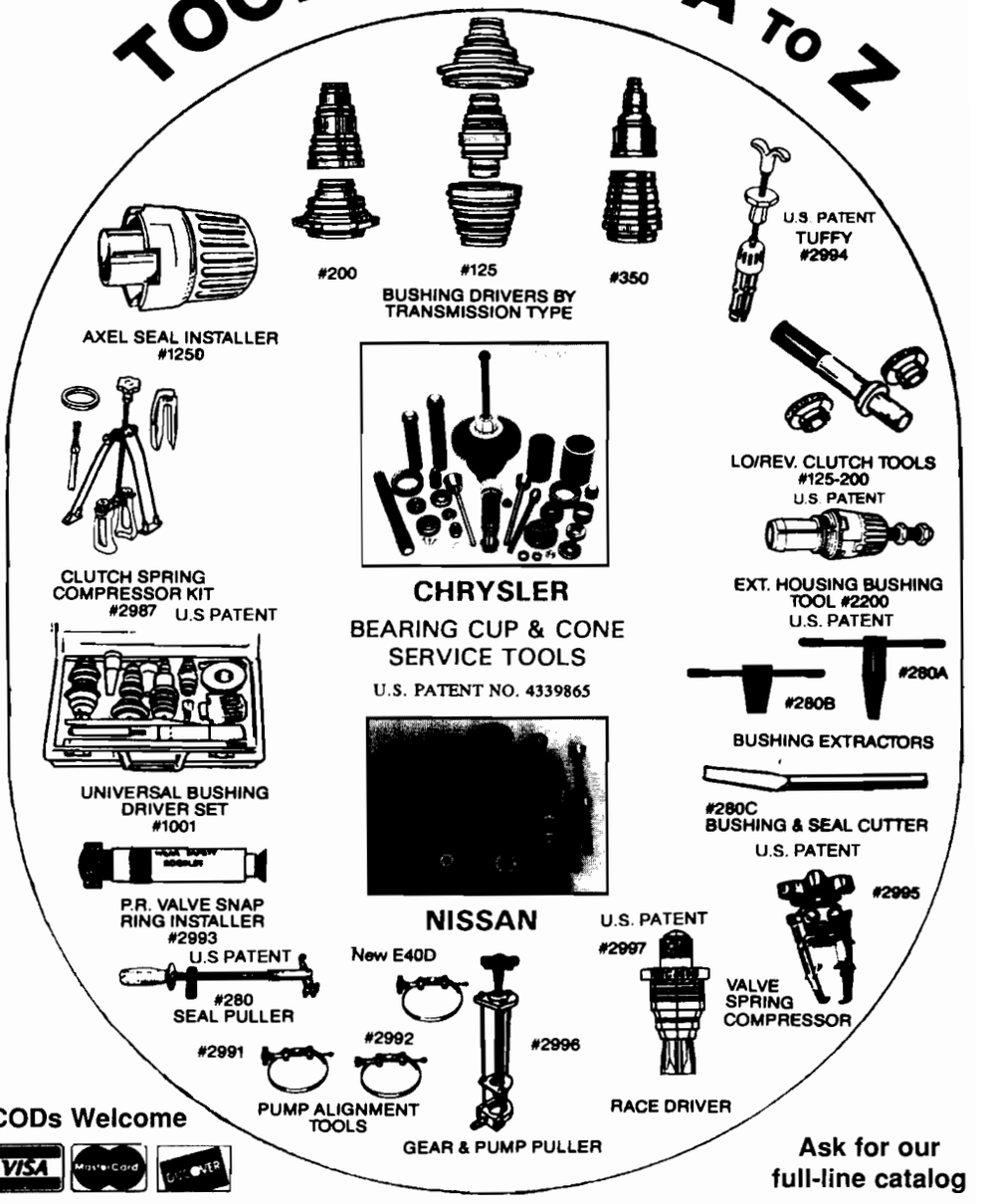


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# SATURN TAAT
## 2nd DRIVEN GEAR DESIGN CHANGE

CHANGE: 1991 and 1992 SL1 and SL2 Sedans and SC Coupes with MP6 and MP7 automatic transaxles built after and including VIN number NZ174649, had eliminated the caged needle bearing for the counter shaft driven 2nd gear (See Figure 17).

REASON: Improved durability.

PARTS AFFECTED:

(1) 2nd DRIVEN GEAR:

The inner diameter of the 2nd driven counter shaft gear was reduced in diameter for a direct gear to race fit. The gear will now run on the inner race that the needle bearing used to run on (See Figure 17).

INTERCHANGEABILITY:

The new design 2nd driven gear with the reduced inner diameter will be the only gear available for service. This gear will retro fit back to earlier models by simply removing the caged needle bearing (See Figure 17).

SERVICE INFORMATION:

MP7 2nd Driven Gear.....21002606
MP6 2nd Driven Gear.....21002605

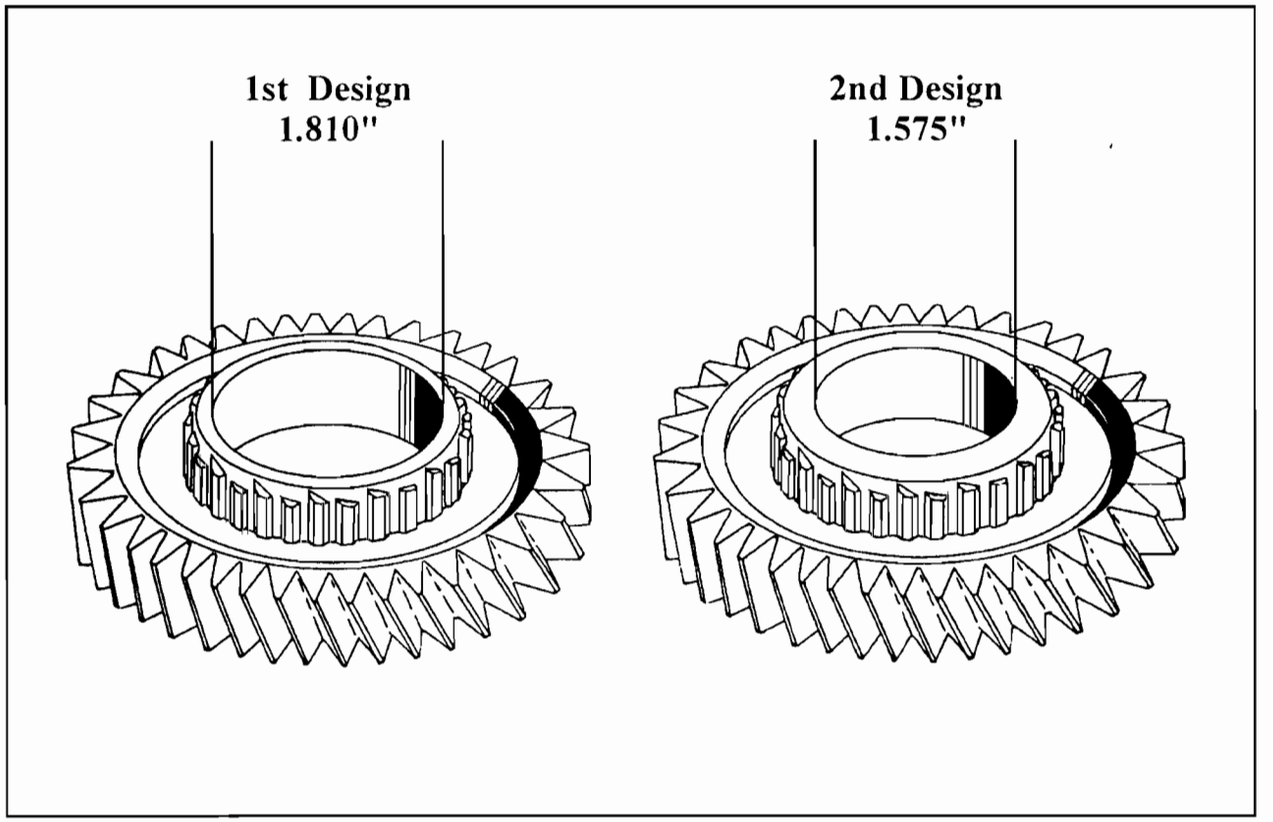



Figure 17

# SATURN

## NEW SHIFT FORK/REVERSE GEAR FOR 91&92 MODELS

**CHANGE:** The Forward and Reverse Shift Fork and Reverse "Driven" gear were changed to the 1993 model year design (2nd design) on 1991 and 1992 model year vehicles.

**REASON:** For better durability and to improve Forward and Reverse engagements.

**PARTS AFFECTED:**

**(1)** Forward and Reverse Shift Fork:
1st Design (91&92) - has a "Reverse side grind" and the Fork thickness is aproximately .160".
***NOTE: 1st design Fork is no longer serviced.*** (See Figure 17a)
2nd design (93) - has "NO" "Reverse side grind" and the Fork thickness is aproximately .190". (See Figure 17)

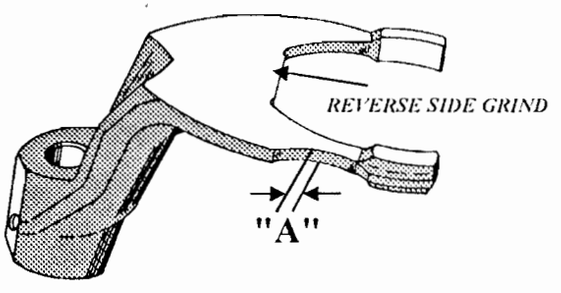
**(2)** Reverse Driven Gear:
1st Design (91&92) - the thickness of the gear is aproximately .512".
***NOTE: 1st design Reverse gear is no longer serviced.*** (See Figure 17b)
2nd Design (93) - the thickness of the gear is aproximately .449". The increase in the Fork thickness made it necessary to reduce the thickness of Reverse gear.(See Figure 17b)

**SERVICE INFORMATION:**

Forward and Reverse Shift Fork and Reverse Driven Gear Kit.....21005969

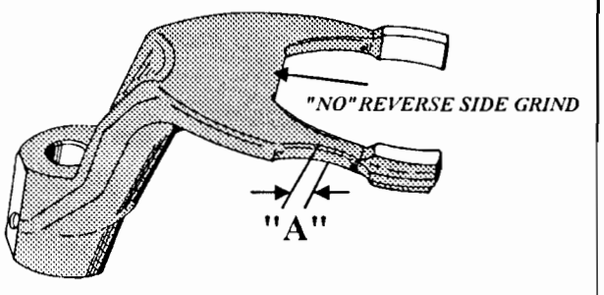
**FORWARD AND REVERSE SHIFT FORK**

**1ST DESIGN**




**DIMENSION "A"=.160"**

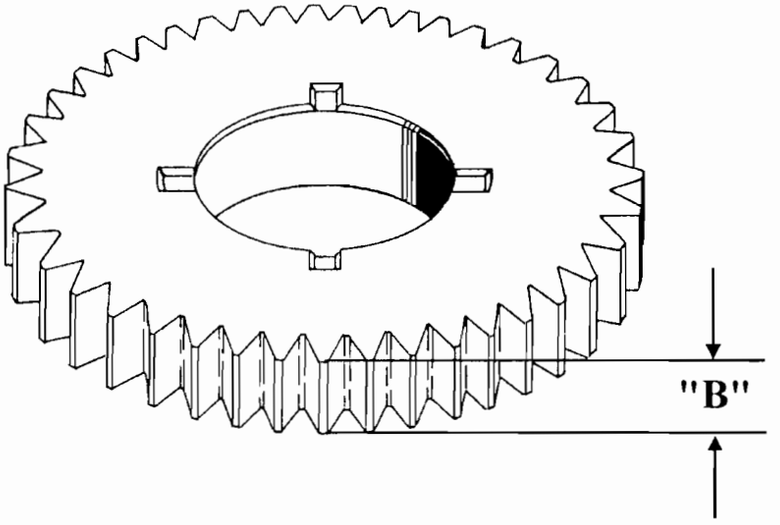
**2ND DESIGN**




**DIMENSION "A"=.190"**

Figure 17a

## REVERSE DRIVEN GEAR




**1ST DESIGN DIMENSION "B" = .512"**
**2ND DESIGN DIMENSION "B" = .449"**

Figure 17b

# 4L80E DIGITAL RATIO ADAPTER CONTROLLER (DRAC)

## VEHICLE SPEED BUFFER

The Digital Ratio Adapter Controller ("DRAC") receives an AC voltage signal from the vehicle speed sensor (VSS). (Refer to figures 18 and 19) The purpose of the "DRAC" is to convert this AC voltage signal to a digital signal which can be interpreted by the PCM/TCM (Refer to Figure 20) as well as changing the frequency of that signal which can then be used by the Speedometer, ABS System, Cruise Control and Idle Air Control.

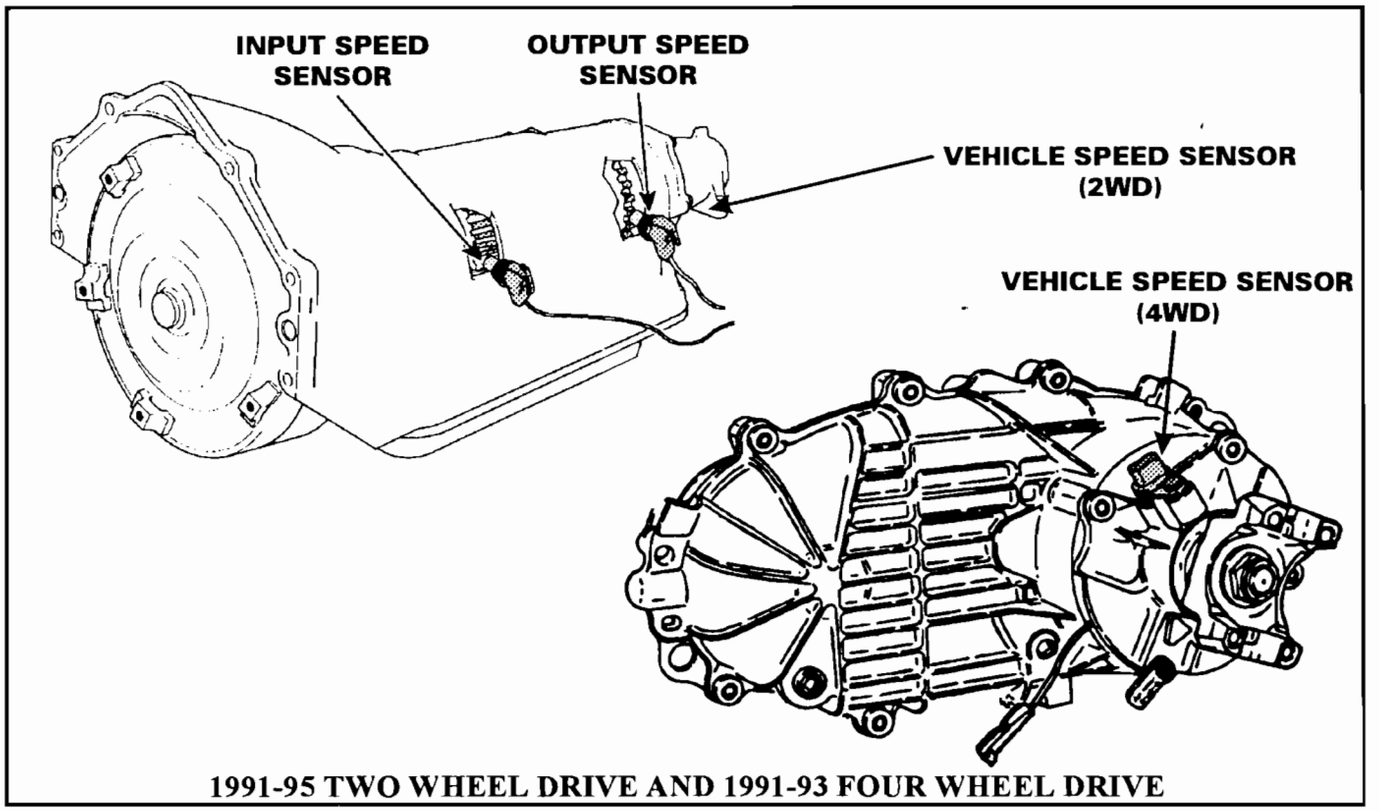
The "DRAC" also allows changes in tire size and axle ratio to be easily adapted to the vehicle systems utilizing "DRAC" modules of different calibrations.

The "DRAC" helps the vehicle computer to calculate vehicle speed by pulsing a voltage signal sent to it by the PCM/TCM at a extremely rapid speed and the PCM/TCM will calculate vehicle speed by monitoring the time between these pulses.

One of the problems the technician has to be aware of is, the owner of the vehicle may change tire and wheel size or change the differential to a different axle ratio which would affect transmission operation as well as the other systems that depend on the "DRAC" for their operation.

Of course, if you are expected to diagnose and repair the "DRAC" the first thing you have to do is **FIND IT!**

The following pages will show you where the "DRAC" is located in the various truck models currently using this system and how to diagnose them.




**1991-95 TWO WHEEL DRIVE AND 1991-93 FOUR WHEEL DRIVE**

Figure 18

# 4L80E DIGITAL RATIO ADAPTER CONTROLLER (DRAC)

## VEHICLE SPEED SENSORS

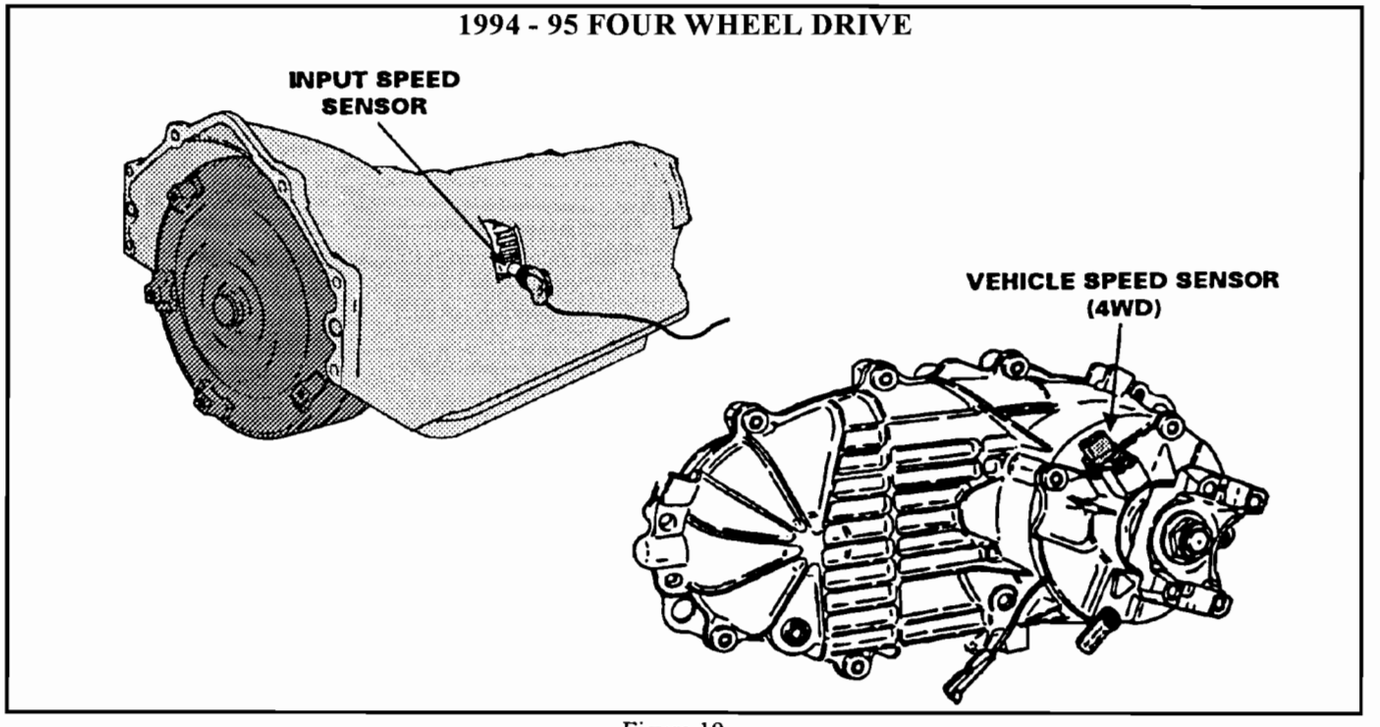



Figure 19

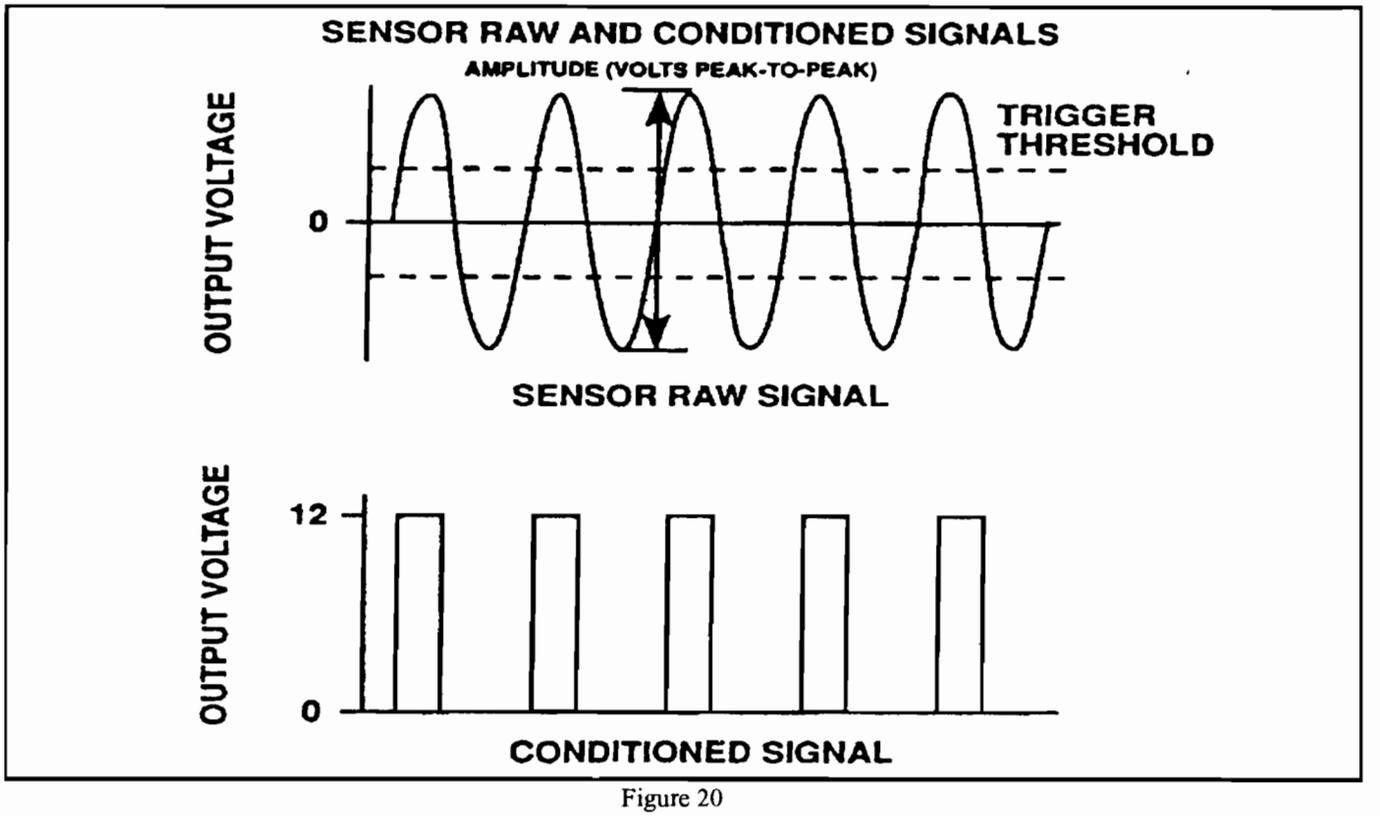
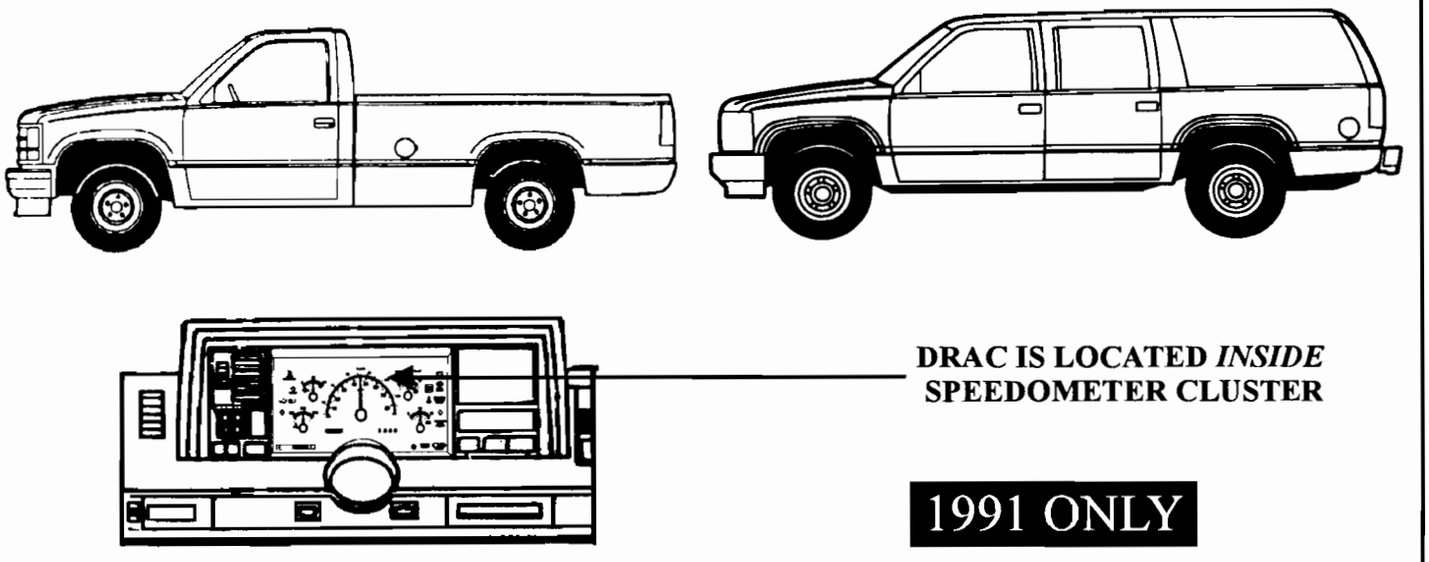



Figure 20

# 4L80E DIGITAL RATIO ADAPTER (DRAC) VEHICLE SPEED BUFFER

## LOCATION AND DIAGNOSIS

### 1991 "C & K" SERIES PICK UP & SUBURBAN





DRAC IS LOCATED *INSIDE* SPEEDOMETER CLUSTER

1991 ONLY

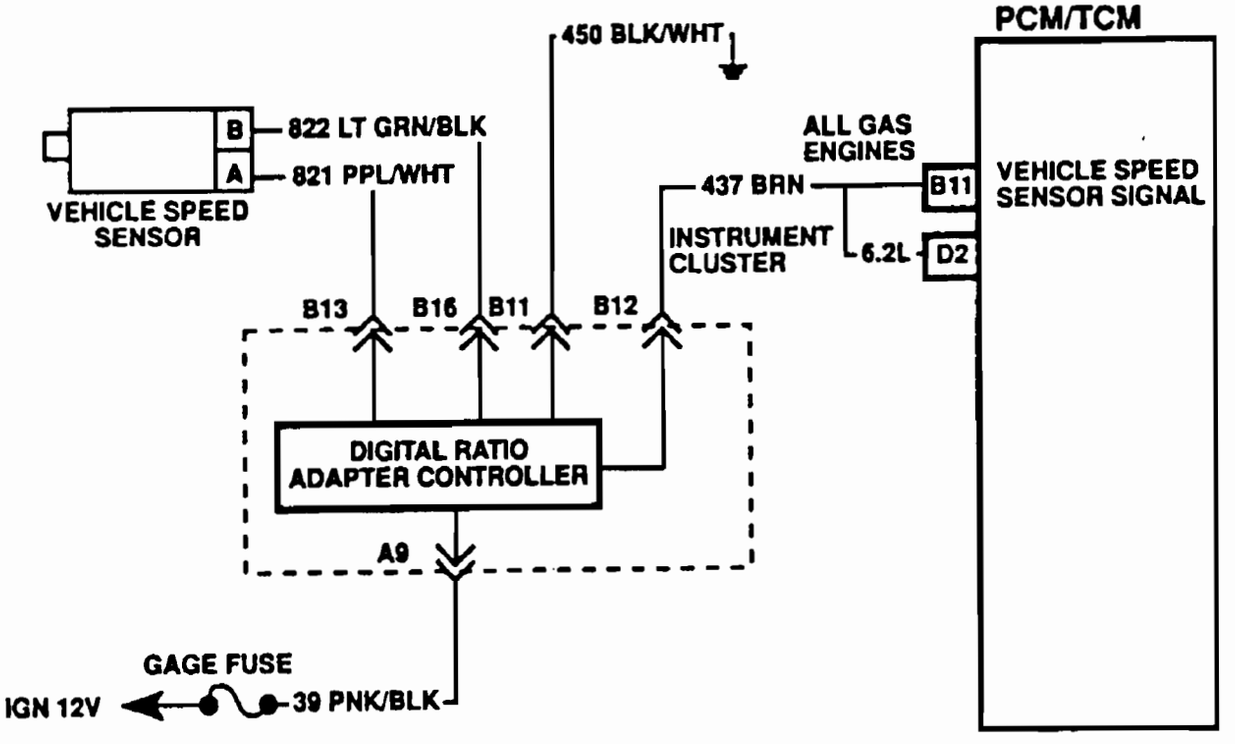



Figure 21

# 1991 "C & K" SERIES 4L80E DRAC CALIBRATION

**SPEEDOMETER CALIBRATION CHART**

| AXLE RATIO | TIRES | RPO | HWY/OOR AT/ALS | PINS TO REMOVE |
|---|---|---|---|---|
| 2.73 | P205/75R15 | (YCE,YCG) | ALS | 1,4,5 |
| (GU2) | P235/75R15 | (YFL,YFN,YFM) | ALS | 3,5 |
| | P195/75R15 | (YAR,YAS) | ALS | 1,2,4,5 |
| | P225/75R15 | (YET,YEV,YEU) | ALS | 2,3,5 |
| 3.08 | P205/75R15 | (YCE,YCG) | ALS | 3,6 |
| (GU4) | P195/75R15 | (YAR,YAS) | ALS | 2,3,6 |
| | P225/75R15 | (YET,YEV,YEU) | ALS | 6 |
| | P236/75R15 | (YFL,YFN,YFM) | ALS/OOR | 2,3,4,5 |
| 3.42 | P205/75R15 | (YCE,YCG) | ALS | 1,3,4,6 |
| (GU6) | P195/75R15 | (YAR,YAS) | ALS | 1,2,3,4,6 |
| | P225/75R15 | (YET,YEV,YEU) | ALS | 1,4,6 |
| | P235/75R15 | (YFL,YFN,YFM) | ALS | 4,6 |
| | LT225/75R16 | (YHE,YHV,YHP,YHQ) | ALS | 2,3,6 |
| | LT245/75R16 | (YHH,YBK,YBL) | ALS | 2,6 |
| | LT265/75R16 | (YGL,YGM) | OOR | 1,2,3,4,5 |
| | LT225/75R16 | (YHR,YHJ,YHN) | OOR | 2,3,6 |
| | LT245/75R16 | (YGK,YBN,YBX) | OOR | 2,6 |
| | 7.50-16LT | (YPF) | HWY | 1,2,3,4,5 |
| 3.73 | P205/75R15 | (YCE,YCG) | ALS | 1,3,5,6 |
| (GT4) | P195/75R15 | (YAR,YAS) | ALS | 1,2,3,5,6 |
| | P225/75R15 | (YET,YEV,YEU) | ALS | 1,5,6 |
| | P235/75R15 | (YFL,YFN,YFM) | ALS | 1,2,3,4,6 |
| | LT225/75R16 | (YHE,YHV,YHQ,YHP) | ALS | 2,3,4,6 |
| | LT245/75R16 | (YHH,YBK,YBL) | ALS | 2,4,6 |
| | 7.50-16LT | (YGF) | HWY | 2,3,6 |
| | LT245/75R16 | (YGK,YBN,YBX) | OOR | 2,4,6 |
| | LT265/75R16 | (YGL,YGM) | OOR | 2,3,6 |
| | LT225/75R16 | (YHR,YHS,YHN) | OOR | 1,3,4,6 |
| 4.10 | LT245/75R16 | (YHH,YBK,BYL) | ALS | 1,2,5,6 |
| (GT5) | LT225/75R16 | (YHP,YHQ) | ALS | 1,2,3,5,6 |
| | 7.50-16LT | (YPF) | HWY | 1,2,3,4,6 |
| | LT225/75R16 | (YHR) | OOR | 2,3,5,6 |
| | LT245/75R16 | (YGK,YBN,YBX) | OOR | 2,5,6 |
| | LT225/75R16 | (YGL,YGM) | OOR | 1,2,3,4,6 |
| 4.56 | LT225/75R16 | (YHR) | OOR | 1,7 |
| (HC4) | LT225/75R16 | (YHP,YHQ) | ALS | 2,7 |
| | LT245/75R16 | (YHH) | ALS | 3,4,5,6 |
| | LT245/75R16 | (YGK) | OOR | 3,4,5,6 |
| | 7.50-16LT | (YPF) | HWY | 4,5,6 |

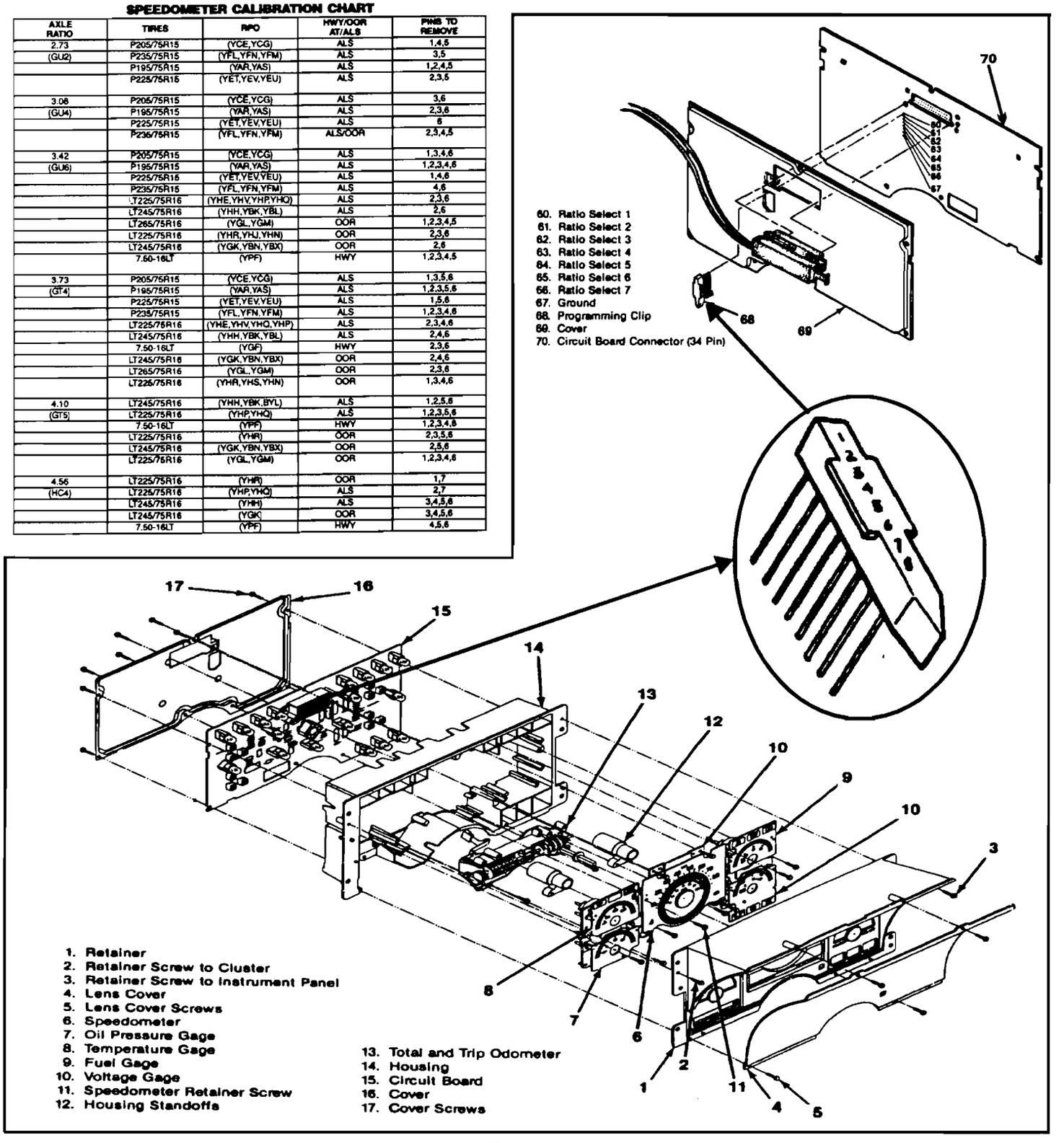



Figure 22

# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1992-95 "C & K" SERIES PICKUP & SUBURBAN

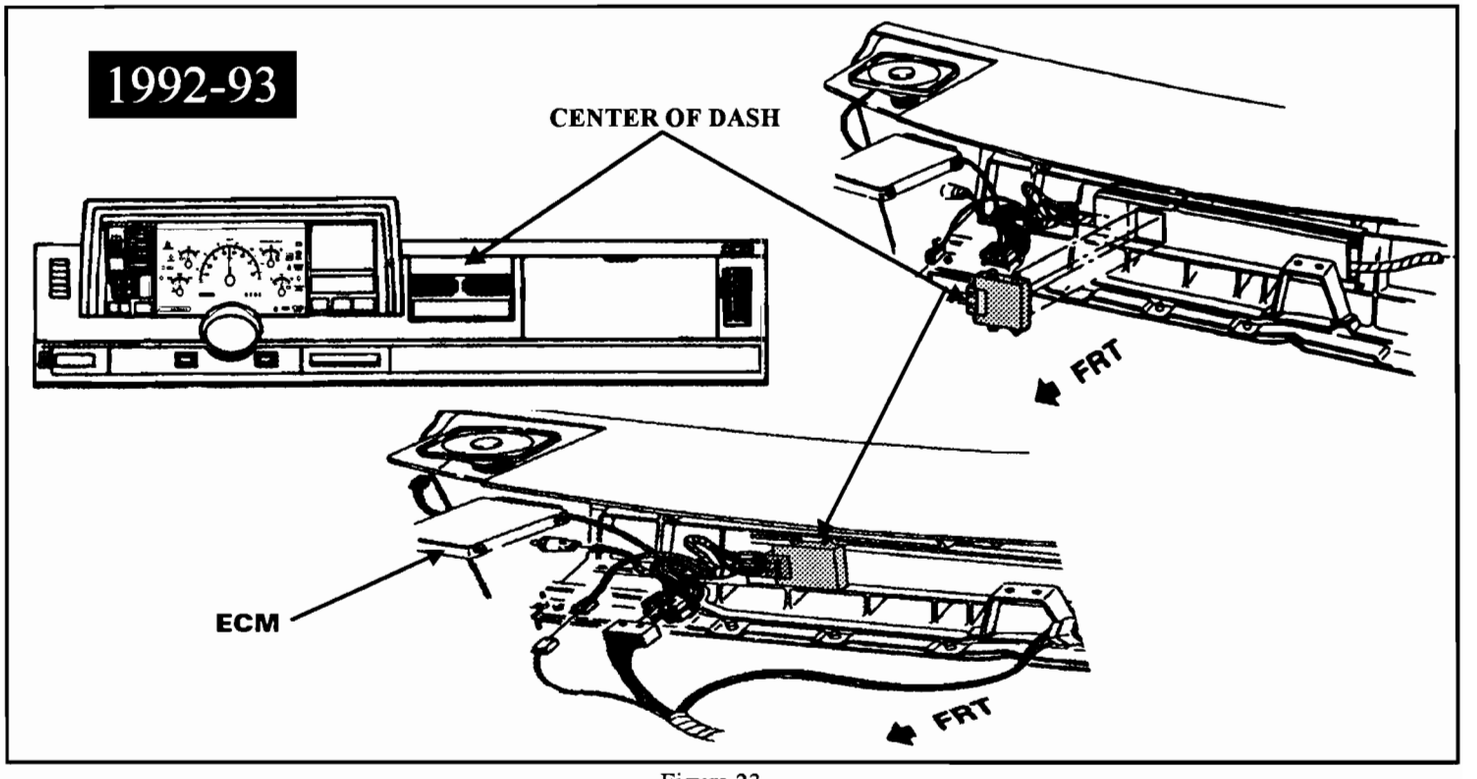



Figure 23

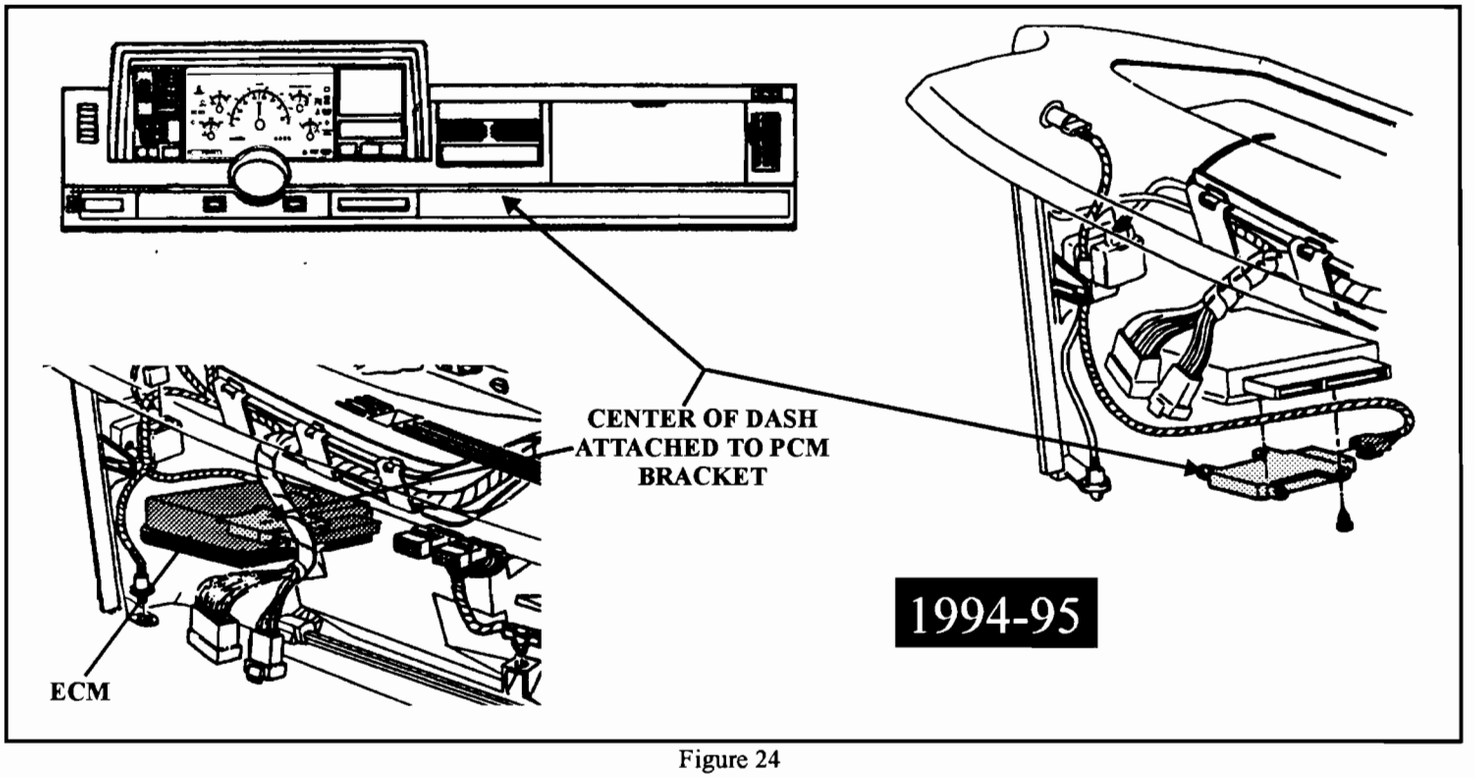
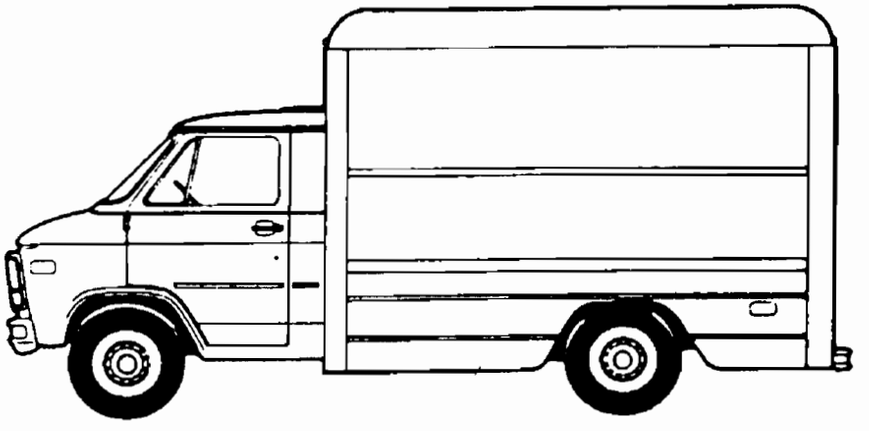
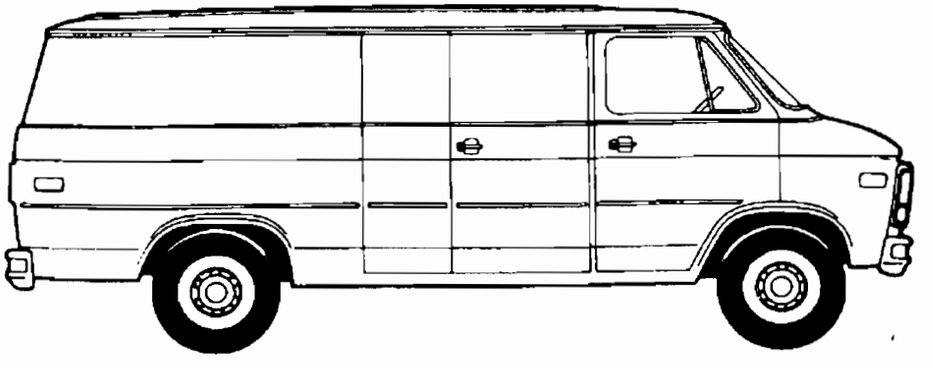



Figure 24

# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1991-95 "G" SERIES VAN





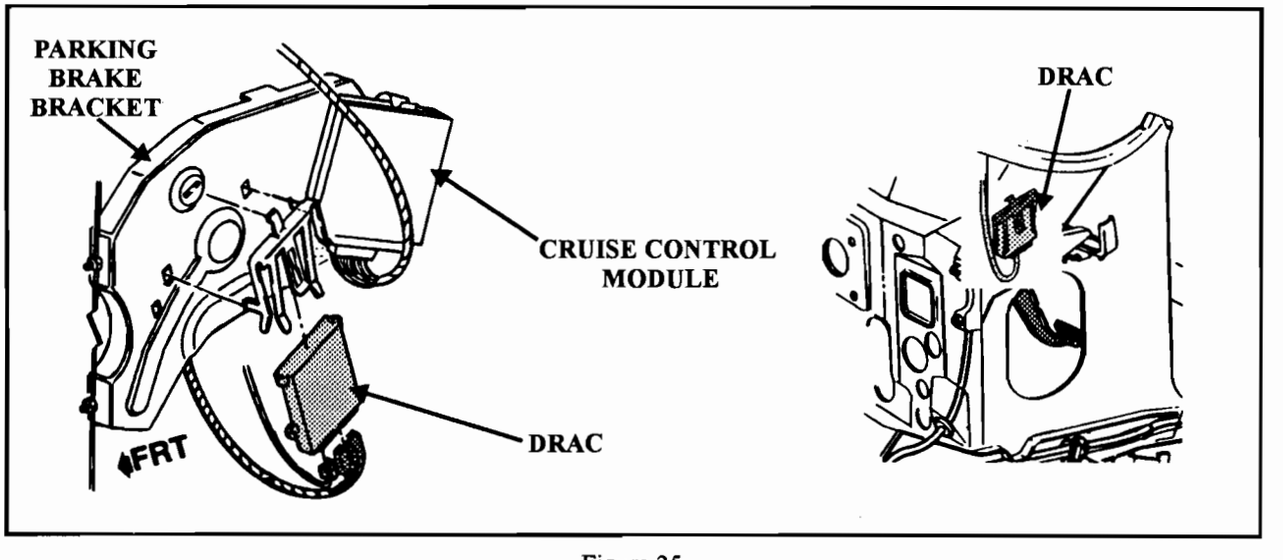



Figure 25

# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1991 R/V SERIES PICK UP TRUCK

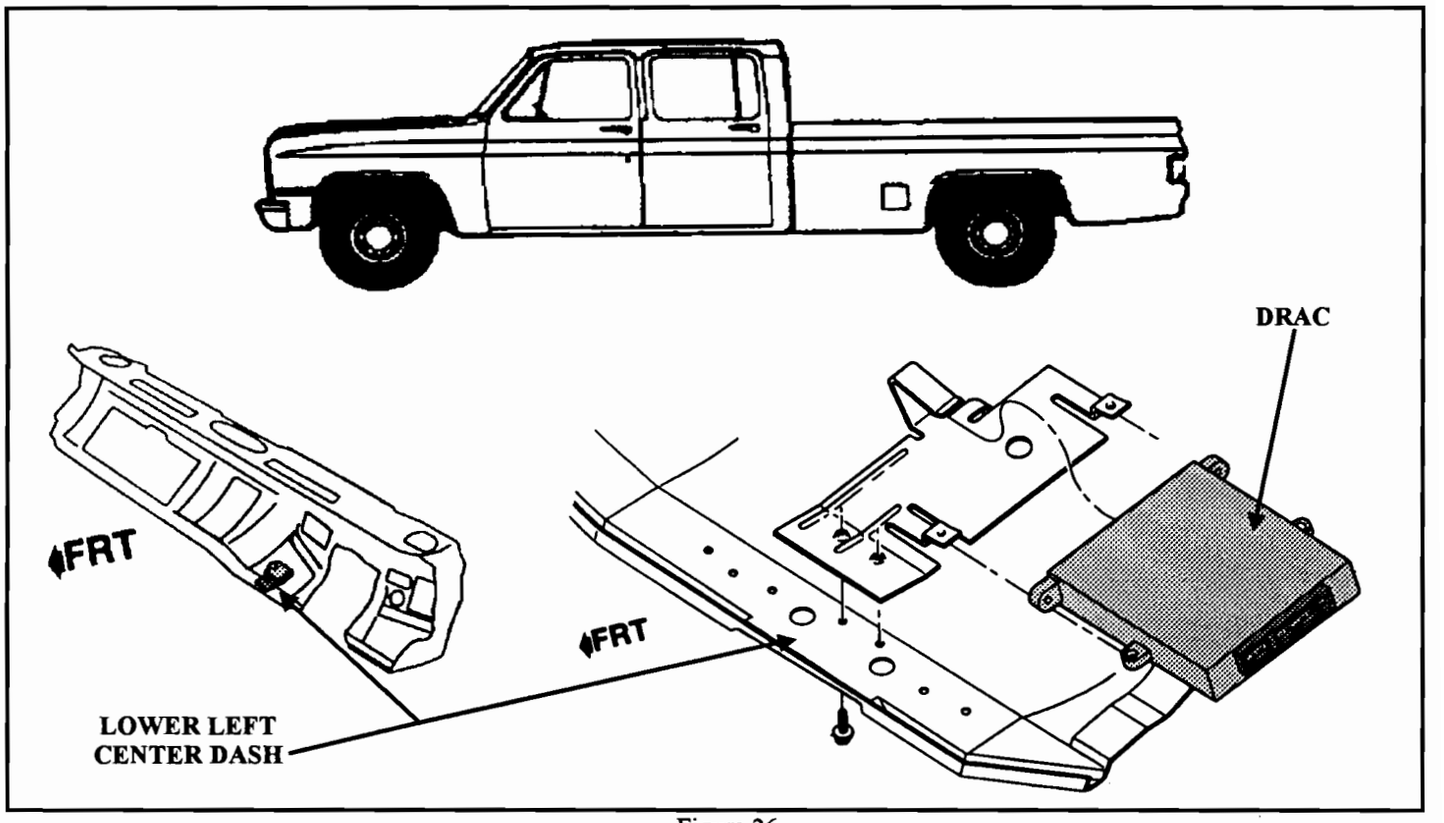



Figure 26

## 1991 "P" SERIES STEP VAN

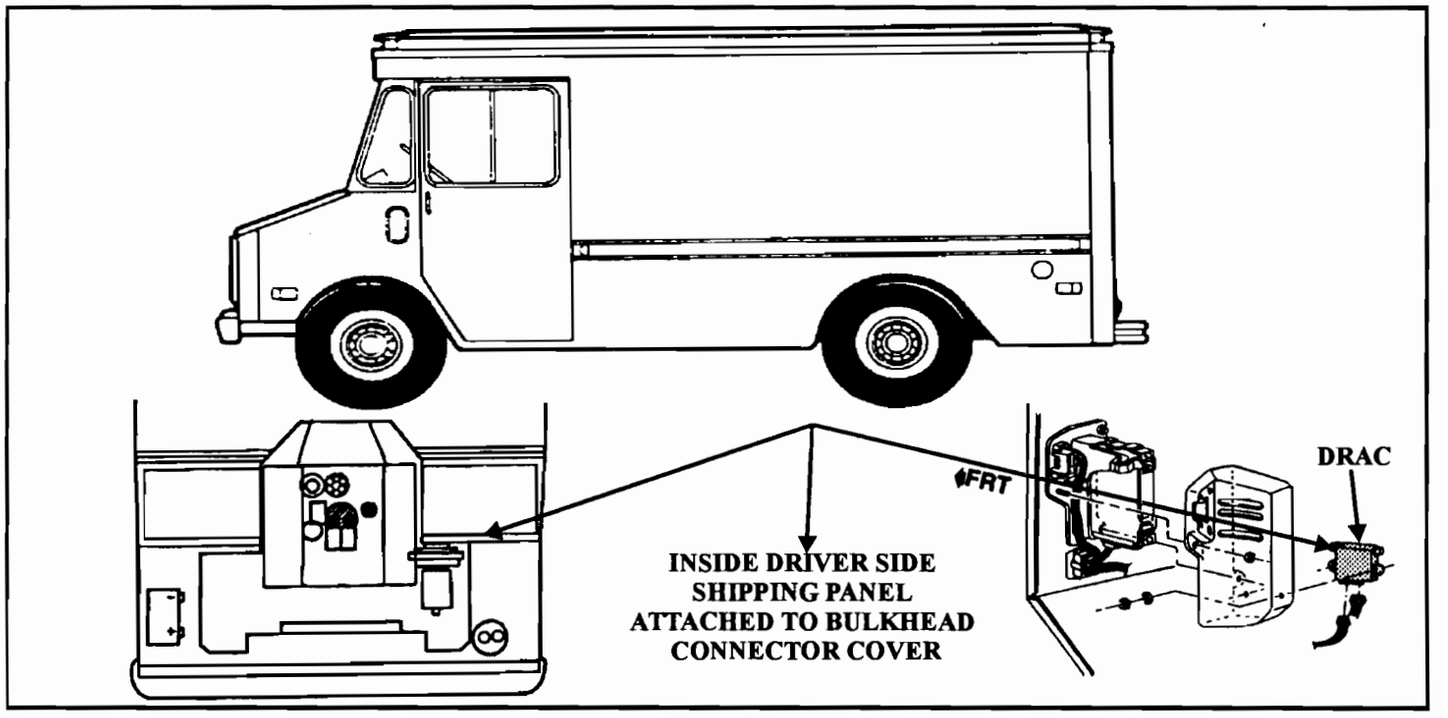



Figure 27

# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1992-95 "P" SERIES STEP VAN

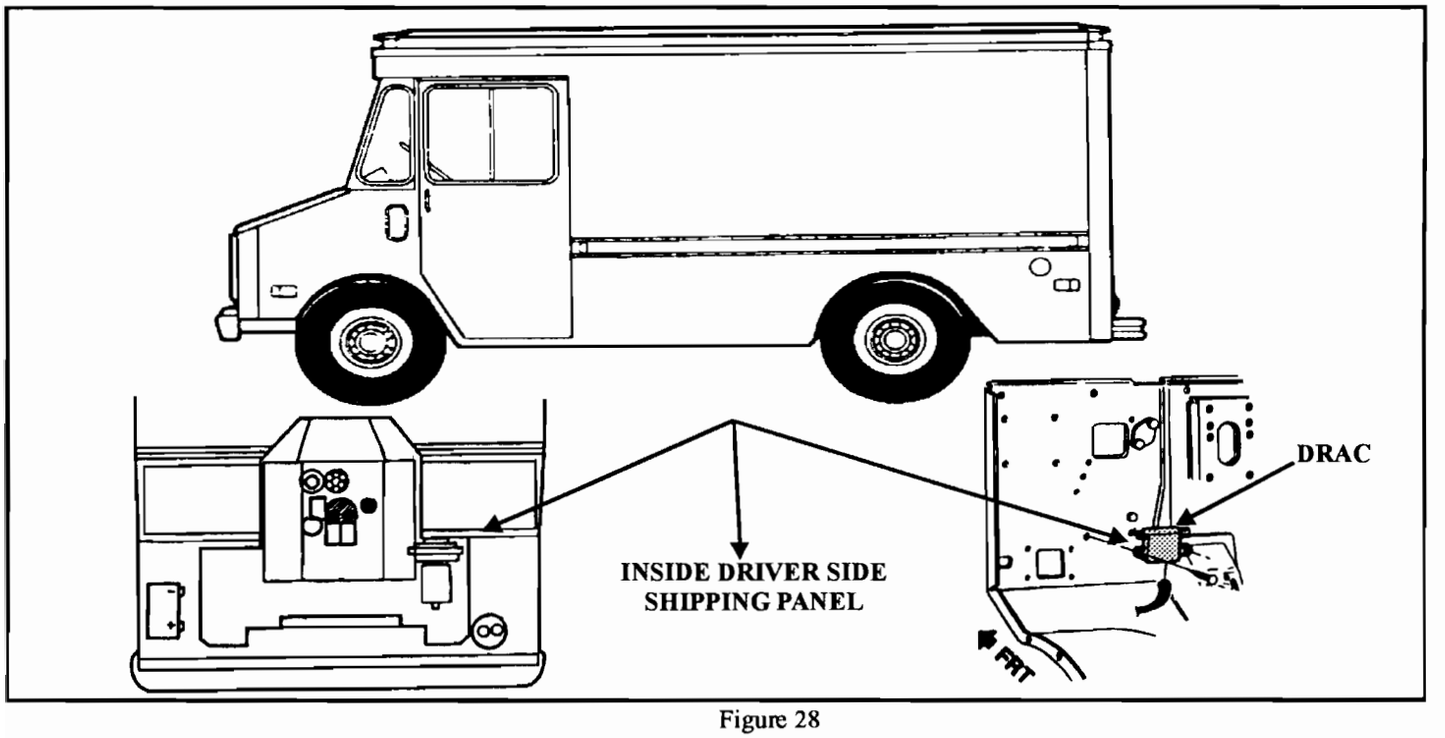



Figure 28

## 1991-95 "P" SERIES MOTORHOME AND FORWARD CONTROL CHASSIS

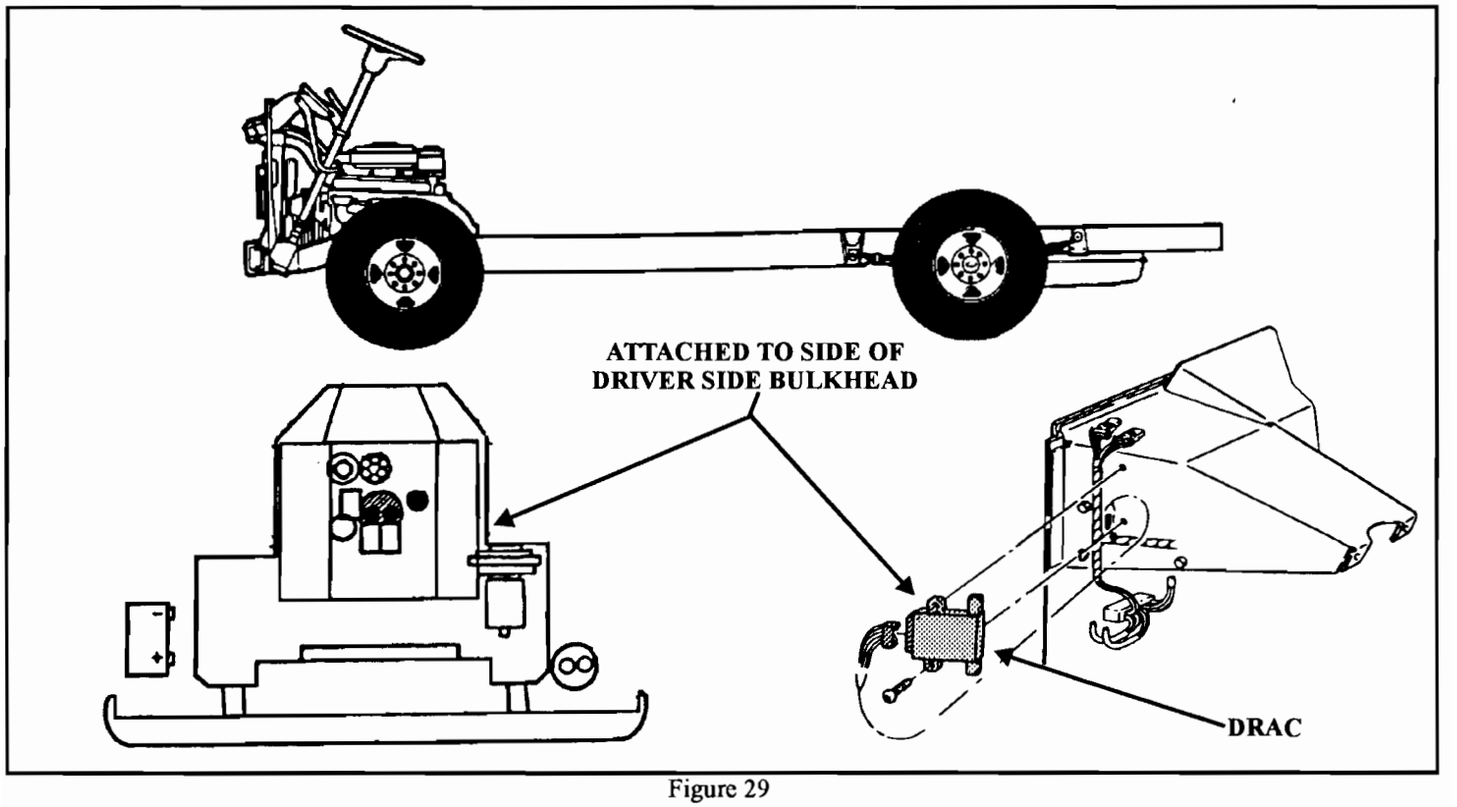



Figure 29

# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1991 C & K 2WD TRUCK WITH INTERNAL DRAC

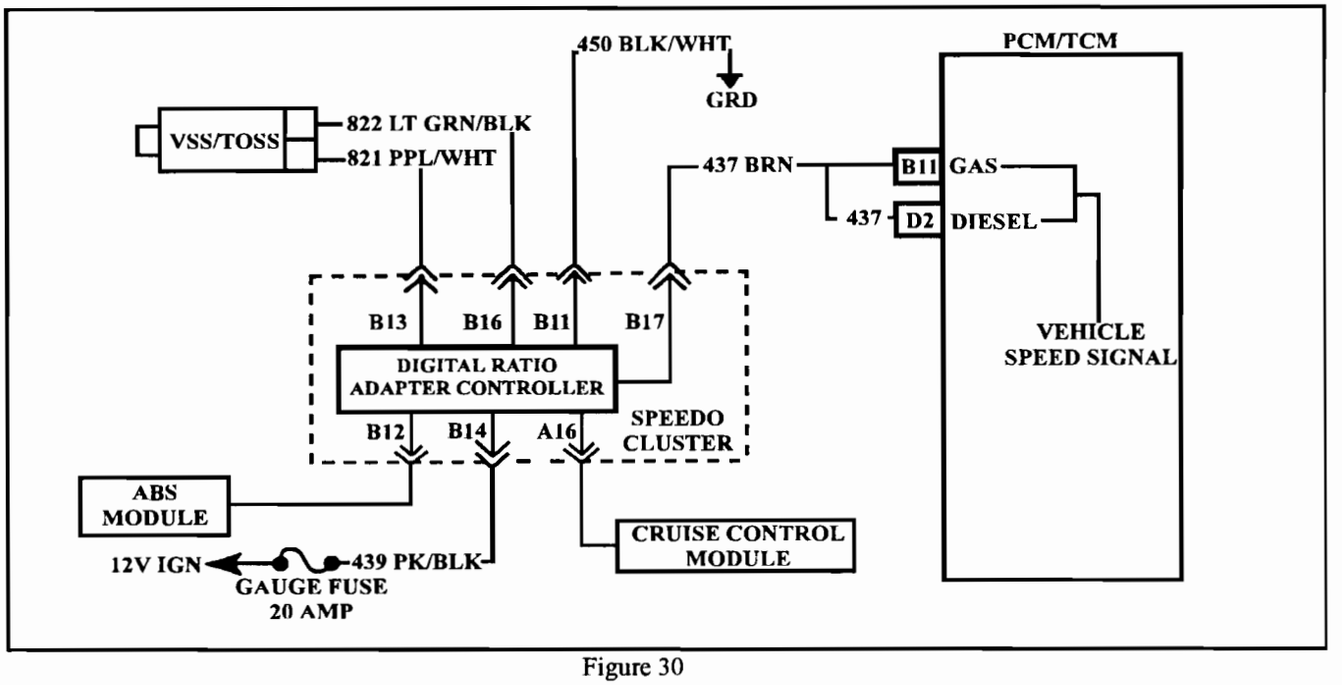
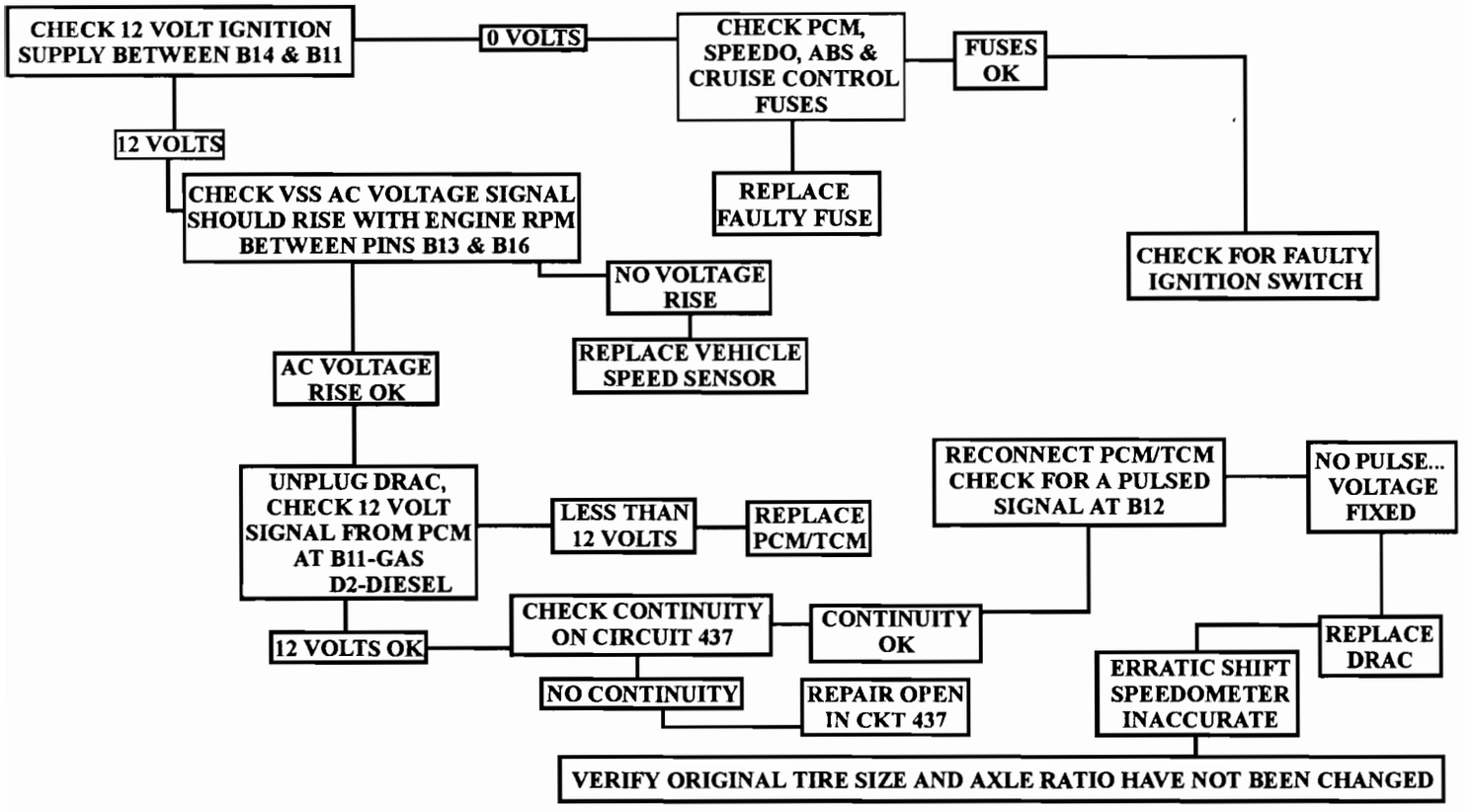



Figure 30

## DTC 24, STUCK IN LOW GEAR, SPEEDOMETER INOPERATIVE



# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1991-93 2WD TRUCKS WITH EXTERNAL DRAC

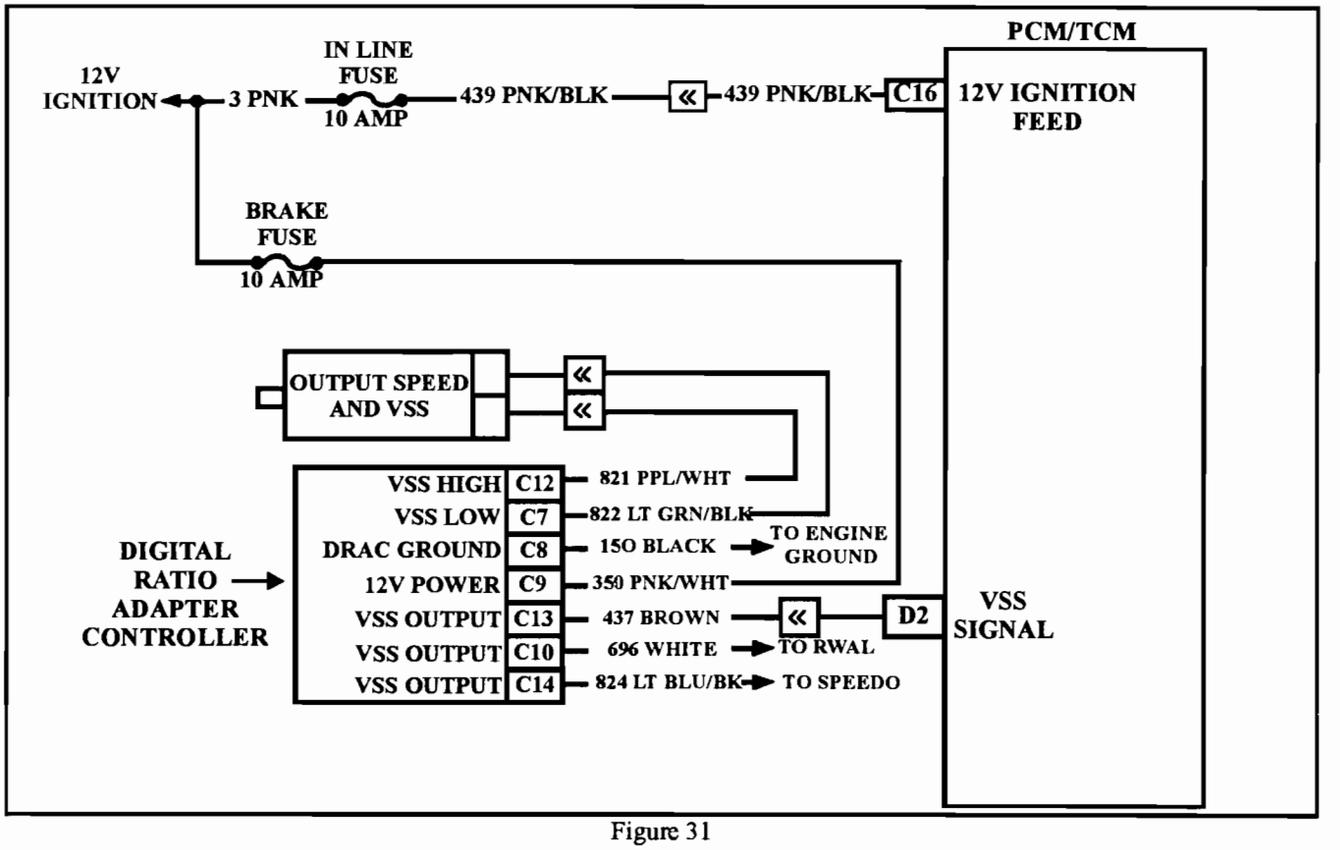
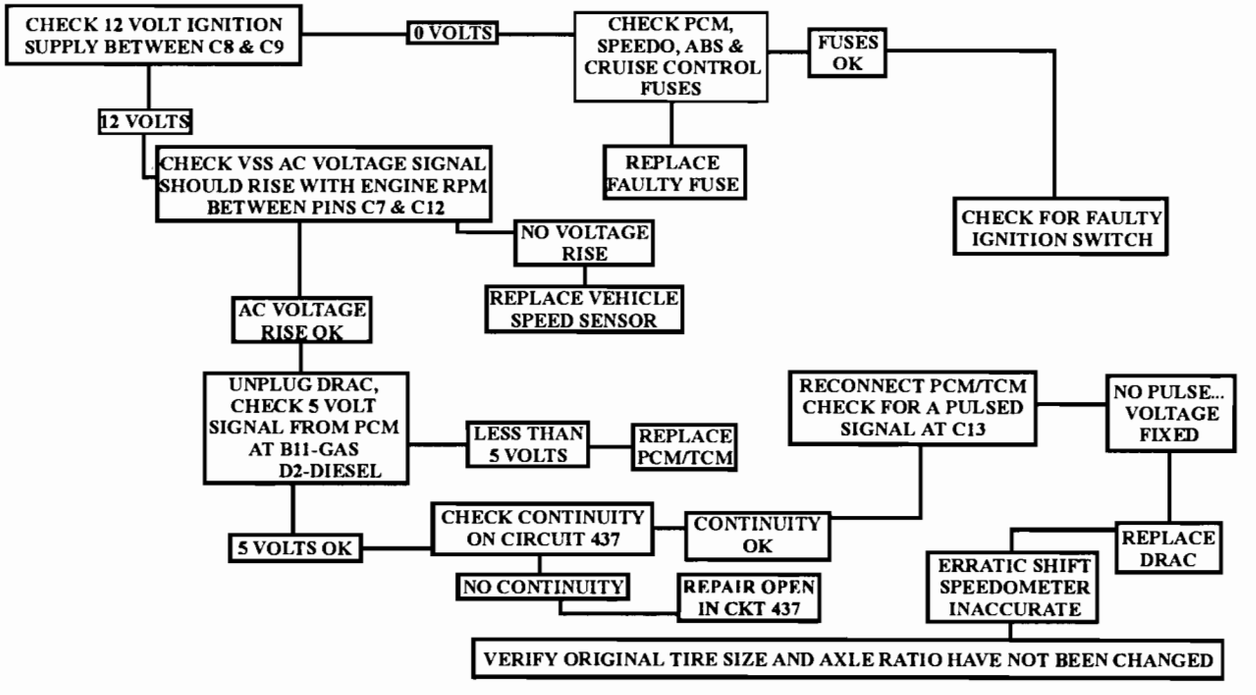



Figure 31

## DTC 24, STUCK IN LOW GEAR, SPEEDOMETER INOPERATIVE



# 4L80E DRAC LOCATION AND DIAGNOSIS

## 1991-93 4WD TRUCKS WITH EXTERNAL DRAC

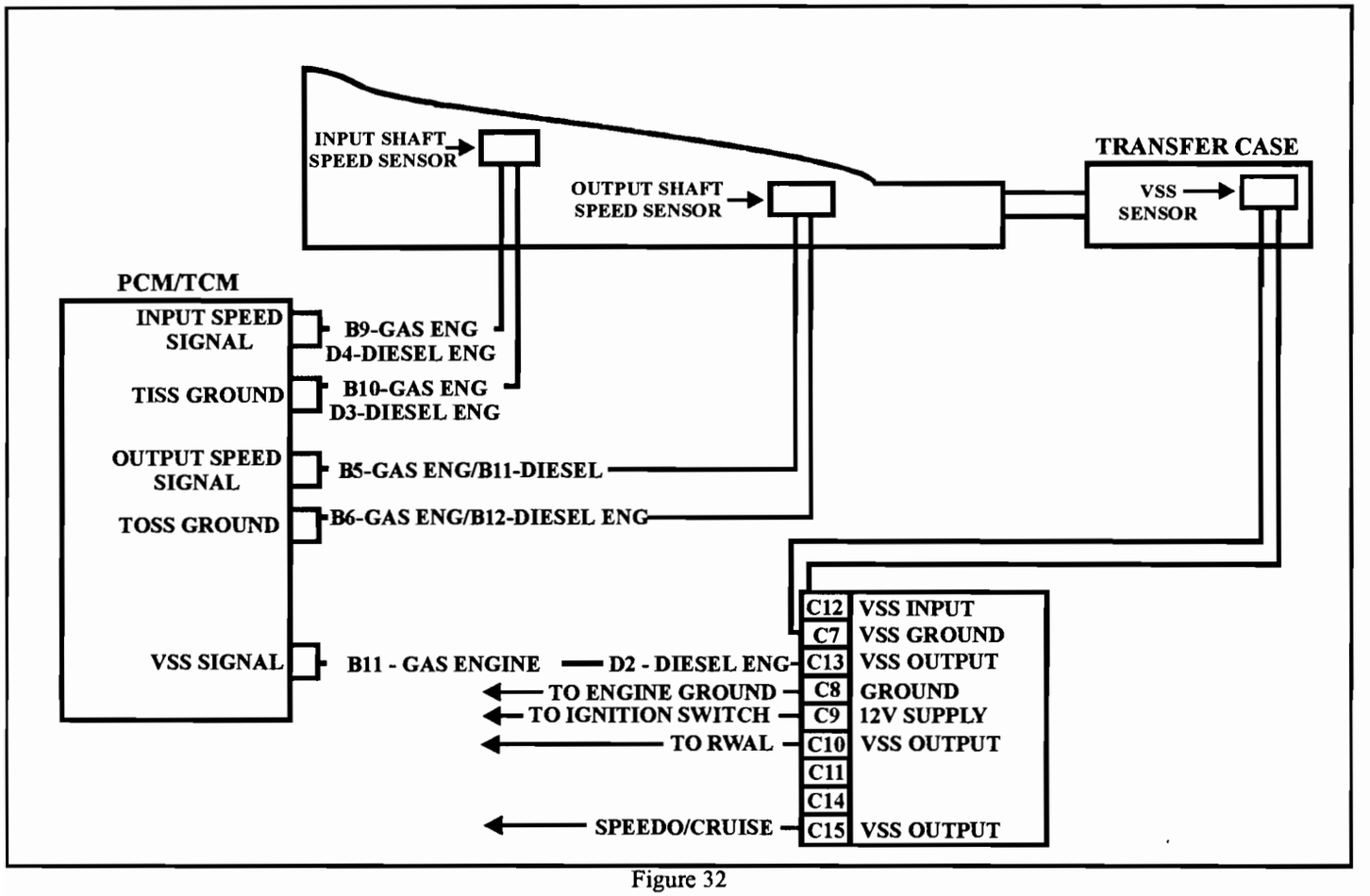



Figure 32

## DTC 24, STUCK IN LOW GEAR, SPEEDOMETER INOPERATIVE

## DTC 24, STUCK IN 2ND GEAR, SPEEDOMETER OK