"2005" SEMINAR INFORMATION

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"Out by Five in 2005" Seminar Information

Introduction

In this manual we would like to extend our gratitude to the companies who sponsor ATSG seminars. Their support to bring technical training into their area benefits all the technicians who attend. Continued education is needed if one determines to do more than just survive. So many areas of the automatic transmission requires education. Mechanically, hydraulically and electronically, the automatic transmission is complex. The wrong fluid or an incorrect part change due to a lack of knowledge can cost a shop time and money. Not to mention the lost credibility the shop receives from the car owner due to a failed rebuilt transmission. For this we thank the companies who sponsor local training and particularly, ATSG technical seminars. If you are successful, we all are successful!

The information and part numbers contained in this booklet have been carefully compiled from industry sources known for their reliability, but ATSG does not guarantee its accuracy.

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Rostra

NISSAN RE4R01A-HD

PARTS INTERCHANGEABILITY

CHANGE: At the start of production for the 2001 model year the RE4R01A underwent significant changes in many of the internal parts which include the pump and converter as well as many of the drive and driven components.

REASON: These changes were implemented in order to create a "heavy duty" version of this transmission to accommodate the more powerful 3.5 Liter engine that the Nissan Pathfinder and Infiniti QX4 were to receive.

PARTS AFFECTED:

(1) The Light Duty Low/Reverse Clutch Piston is .965" tall and uses individual return springs and retainer.
The Heavy Duty Low/Reverse Piston is .709" tall and uses a return spring assembly.

(2) The Light Duty Forward Drum has a 3.78" opening for the sprag which is a 34 element unit (Refer to Figure 1) and the low/reverse clutch lug area is1.77" tall.
The Heavy Duty Forward Drum has a 3.86" diameter opening for the sprag which is a 30 element unit and the low/reverse clutch lug area is1.65" tall.

(3) The Light Duty Overrun Sprag Outer Race is stamped and has an overall height of 2.382"
The Heavy Duty Overrun Sprag Outer Race is cast and has an overall height of 2.47"

(4) The Light Duty Rear Planet is a Four (4) Pinion design, (Refer to Figure 2).
The Heavy Duty Rear Planet is a Five (5) Pinion design, (Refer to Figure 2).

(5) The Light Duty Front Planet is a Three (3) Pinion design and the pinions are riveted.
The Heavy Duty Front Planet is a Four (4) Pinion design and the pinions are held in by screws, (Refer to Figure 3).

(6) The Light Duty High Clutch Hub is .875" in overall height, (Refer to Figure 4).
The Heavy Duty High Clutch Hub is 1.133" in overall height, (Refer to Figure 4).

(7) The Light Duty High Clutch Drum is stamped and is 2.030" in overall height. It will accept up to Four (4) Friction Plates. The Reverse Input Clutch Hub at the bottom of the drum is 5.295" in diameter, (Refer to Figure 5).
The Heavy Duty High Clutch Drum is a thicker stamping and is 2.505" in overall height. It will accept up to Five (5) Friction Plates. The Reverse Input Clutch Hub at the bottom of the drum is 5.017" in diameter, Refer to Figure 5).

(8) The Light Duty Front Sun Gear is an Eight (8) Lug design.
The Heavy Duty Front Sun Gear is a Twelve (12) Lug design, (Refer to Figure 6).

(9) The Reverse Input Friction Plates for the Light Duty and Heavy Duty both have 30 teeth. However, the Light Duty Friction Plates have a LARGER inside diameter then the Heavy duty Friction Plates have.

(10) The Light Duty Reverse Input Drum is stamped and is 2.559" in overall height. The drum has Eight (8) Lugs in order to accommodate the Eight (8) Lug Front Sun Gear.
The Heavy Duty Reverse Input Drum is cast and is 3.011" in overall height. The drum has Twelve Lugs in order to accommodate the Twelve (12) Lug Front Sun Gear, (Refer to Figure 6).

(11) The light Duty 2-4 Band is 2.250" wide, (Refer to Figure 7).
The Heavy Duty Band is approximately 2.750" wide, (Refer to Figure 8).

(12) A number of the Internal Bearings have changed from the closed one piece design to the open two piece design.

NISSAN RE4R01A-HD

PARTS INTERCHANGEABILITY

INTERCHANGEABILITY:

continued: Interchange of all the above mentioned parts is possible, however, a great deal of attention must be paid to clearances between all involved components.

Care must be taken when exchanging pump assemblies since some pump covers have provisions for a Turbine Speed Sensor and some do not. The use of this speed sensor also requires a case that can accommodate the sensor, (it has a hole).

The input shaft must also have a splined reluctor to excite the turbine speed sensor as some do not have these splines.

NOTE: If you put a pump in that has the hole for the turbine speed sensor without the speed sensor in the hole, you will have a no move condition because all converter charge oil will be dumped out of the speed sensor hole.

Many thanks to Paul at Hardparts For Transmissions for supplying the parts that made this the presentation of this information possible.

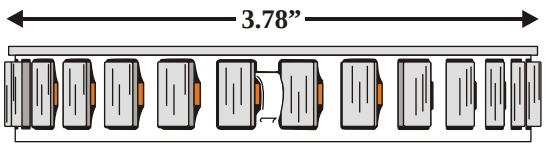
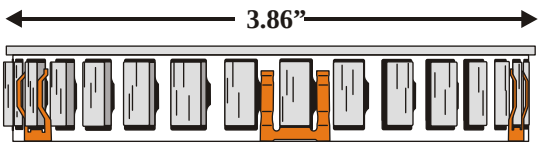
PREVIOUS DESIGN LOW SPRAG	CURRENT DESIGN LOW SPRAG
	
34 ELEMENTS	***30 ELEMENTS***

Figure 1

HEAVY DUTY 5 PINION REAR PLANET

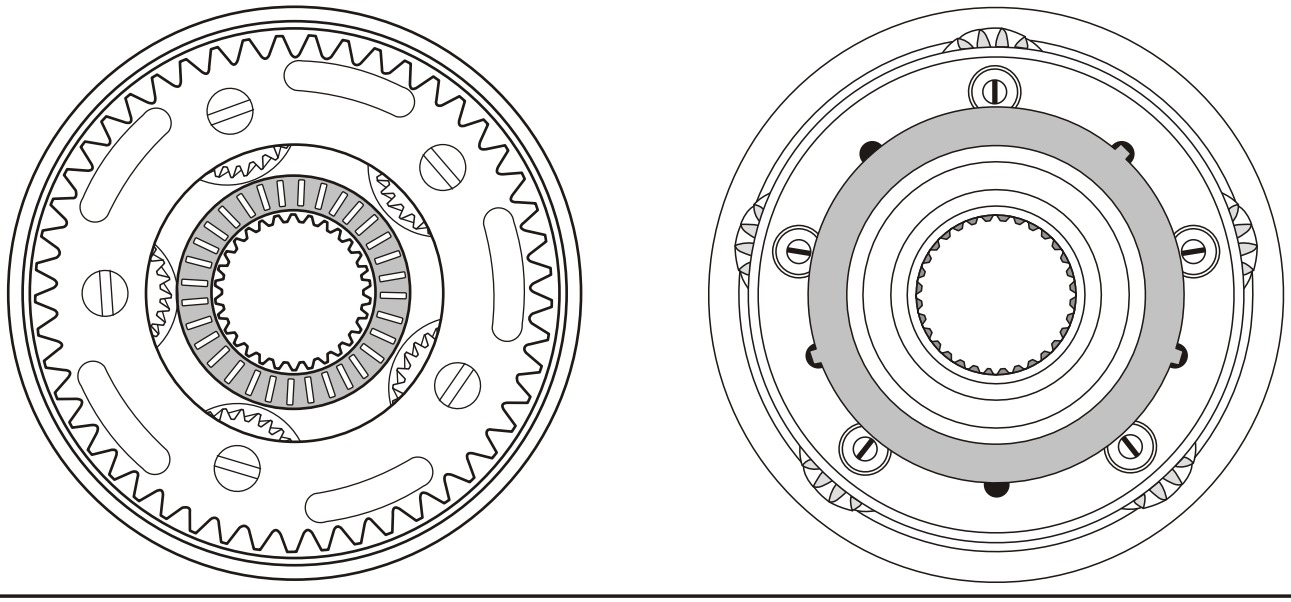


Figure 2

PARTS INTERCHANGEABILITY

HEAVY DUTY 4 PINION FRONT PLANET

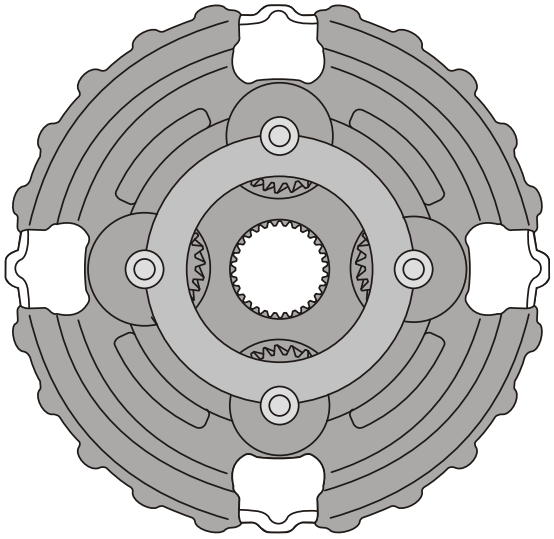
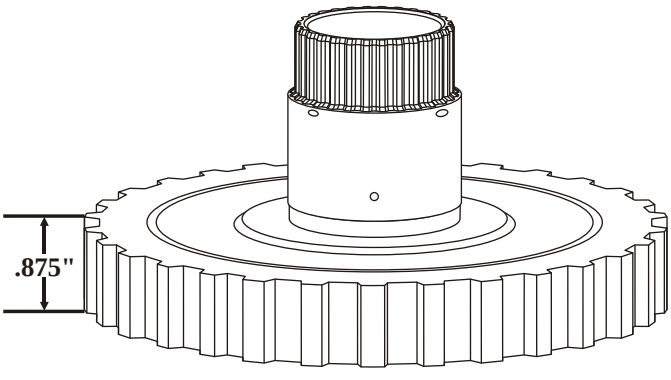


Figure 3

LIGHT DUTY HIGH CLUTCH HUB



HEAVY DUTY HIGH CLUTCH HUB

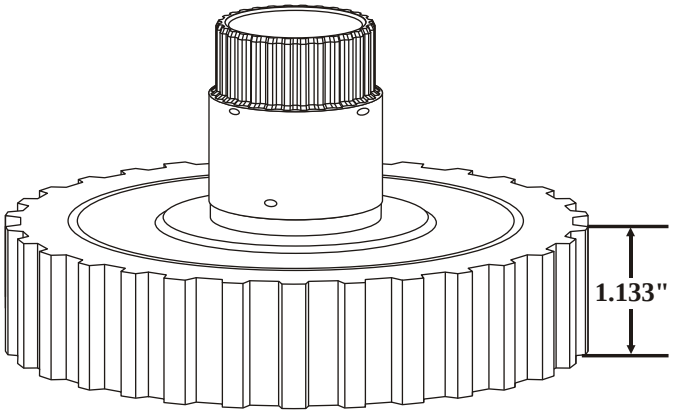


Figure 4

PARTS INTERCHANGEABILITY

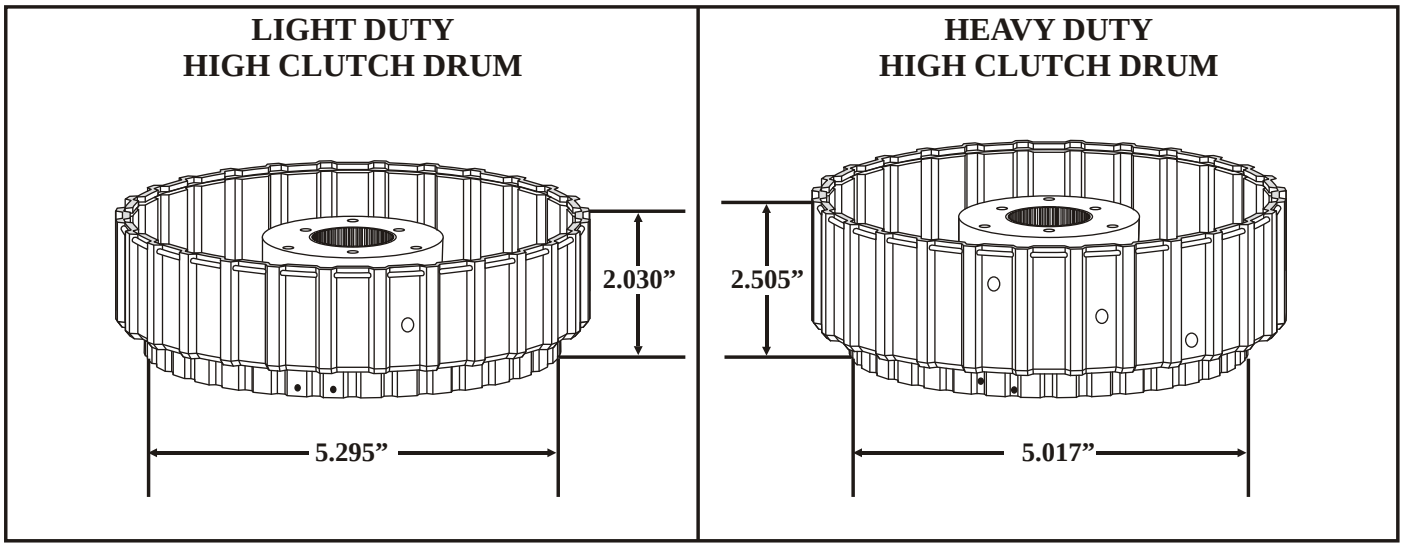


Figure 5

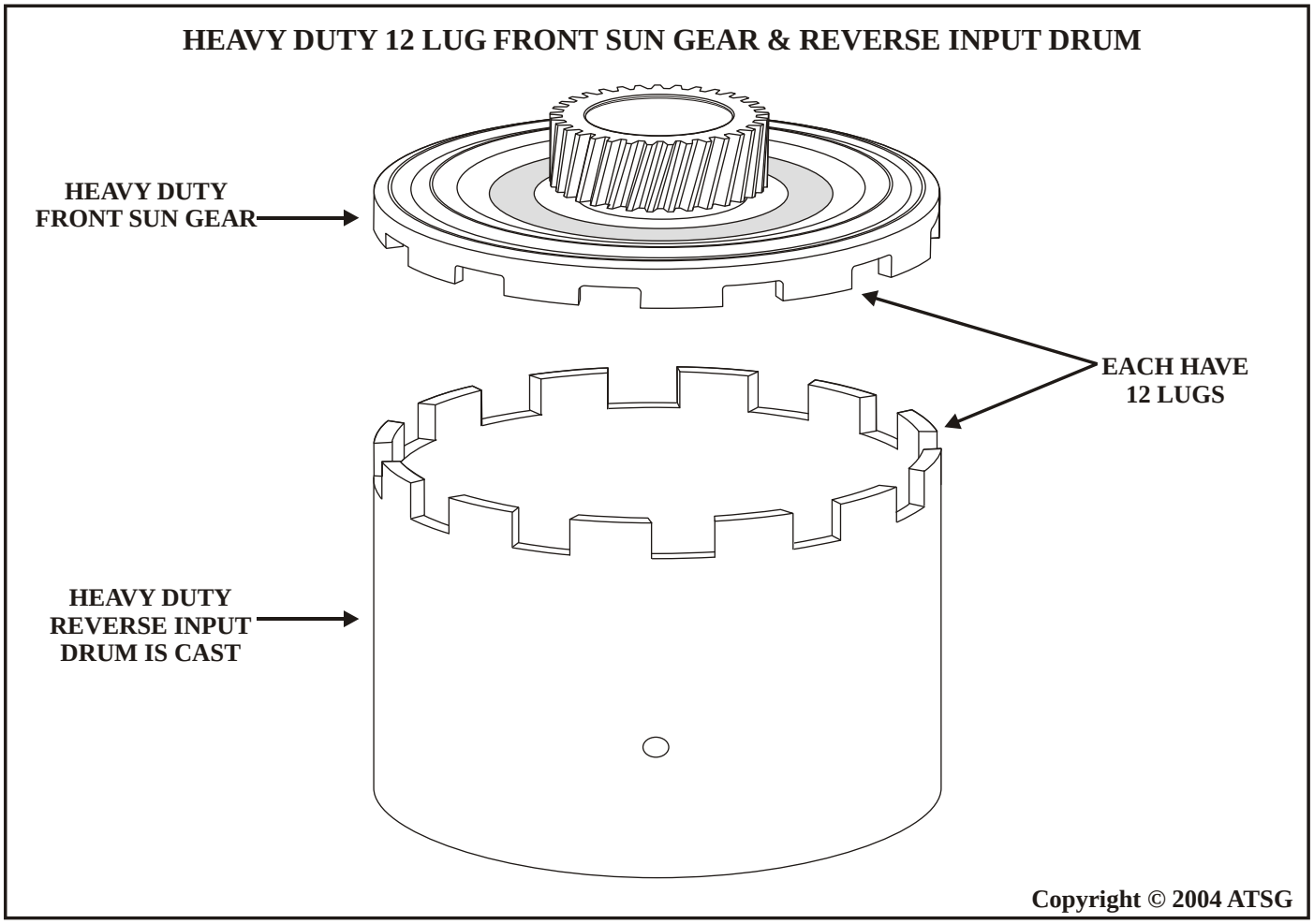


Figure 6

PARTS INTERCHANGEABILITY

LIGHT DUTY 2-4 BAND

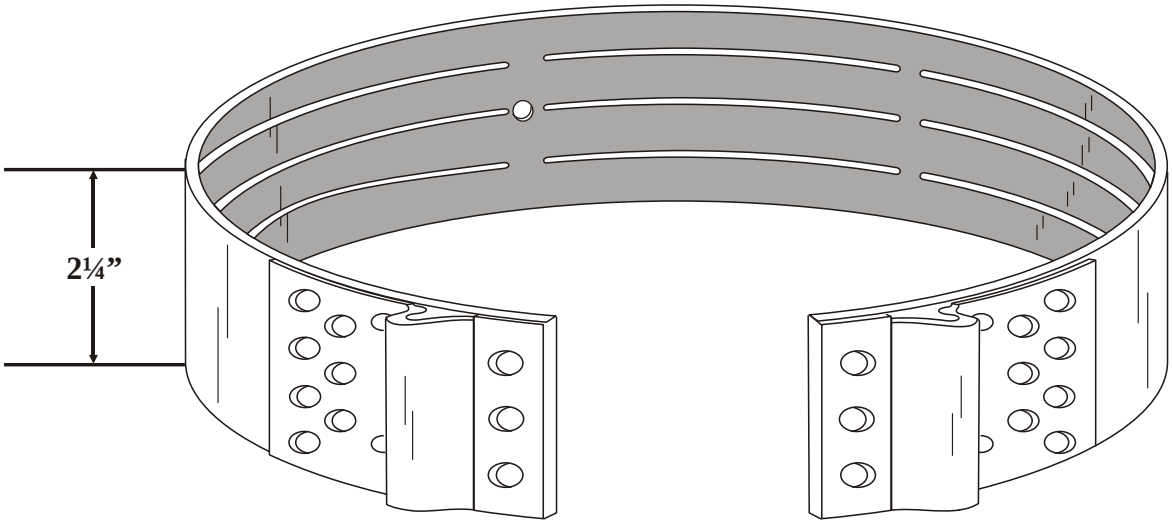


Figure 7

HEAVY DUTY 2-4 BAND

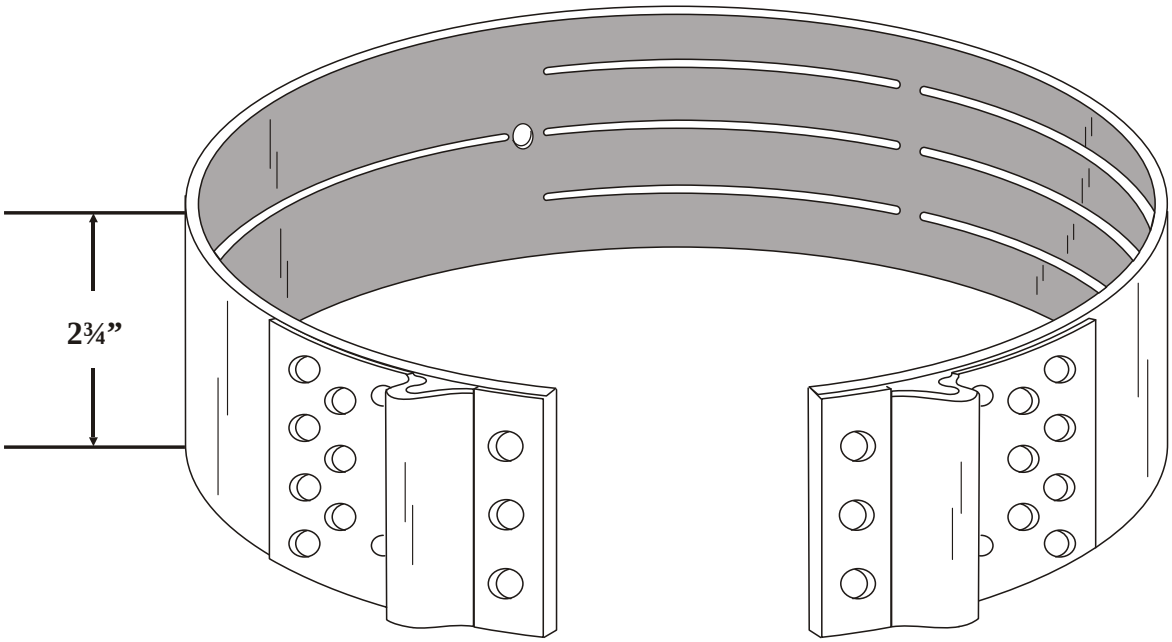


Figure 8

NISSAN/INFINITI/MERCURY
ALTIMA/MAXIMA/G20/I30/QUEST/VILLAGER
HARSH SHIFTING CODE P0745

COMPLAINT: Before or after an overhaul a vehicle equipped with the RE4FO4A/V automatic transaxle exhibits a harsh shift condition. The complaint is generally described as a harsh 1-2 shift with other shifts feeling acceptable. This problem may or may not set code P0745.

CAUSE: Potential causes could be the EPC solenoid, shorted or open wire harness, corroded connectors, a faulty dropping resistor, or a bad computer.

CORRECTION: Use the following procedures to trouble-shoot and fix a problem in the line pressure control solenoid circuit.

Step 1: Check the resistance of the pressure control solenoid. Pressure control solenoid resistance should be approximately 2.5-5 ohms. Refer to ***Figure 1*** for connector configuration and resistance check. If the resistance is between 2.5-5 ohms, go to ***Step 2***.

Step 2: Locate and check the resistance of the dropping resistor. Refer to ***Figure 2*** for the dropping resistor resistance check. The dropping resistor should measure between 11.2 and 12.8 ohms. If the dropping resistor resistance is not between 11.2 and 12.7 ohms, replace the Resistor. If the resistance check is between 11.2 and 12.8 ohms, proceed to ***Step 3***. Refer to ***Figure 5*** for TCM and dropping resistor locations by model/year.

Step 3: Plug the dropping resistor connector back in and turn the ignition "ON". Back-probe terminal 1 of the dropping resistor. The voltage should be between 5 and 14 volts with the throttle closed. As the accelerator pedal is depressed the voltage will drop to approximately .45 volts. Next back-probe terminal 2 at the dropping resistor. The voltage should be between 1.5 and 2.5 volts. As the accelerator pedal is depressed the voltage will drop to approximately .45 volts. Refer to ***Figure 3*** for connector view and voltage check at the wire from the computer to the dropping resistor. Refer to ***Figure 4*** for connector view and voltage check on the wire that goes to the pressure control solenoid.

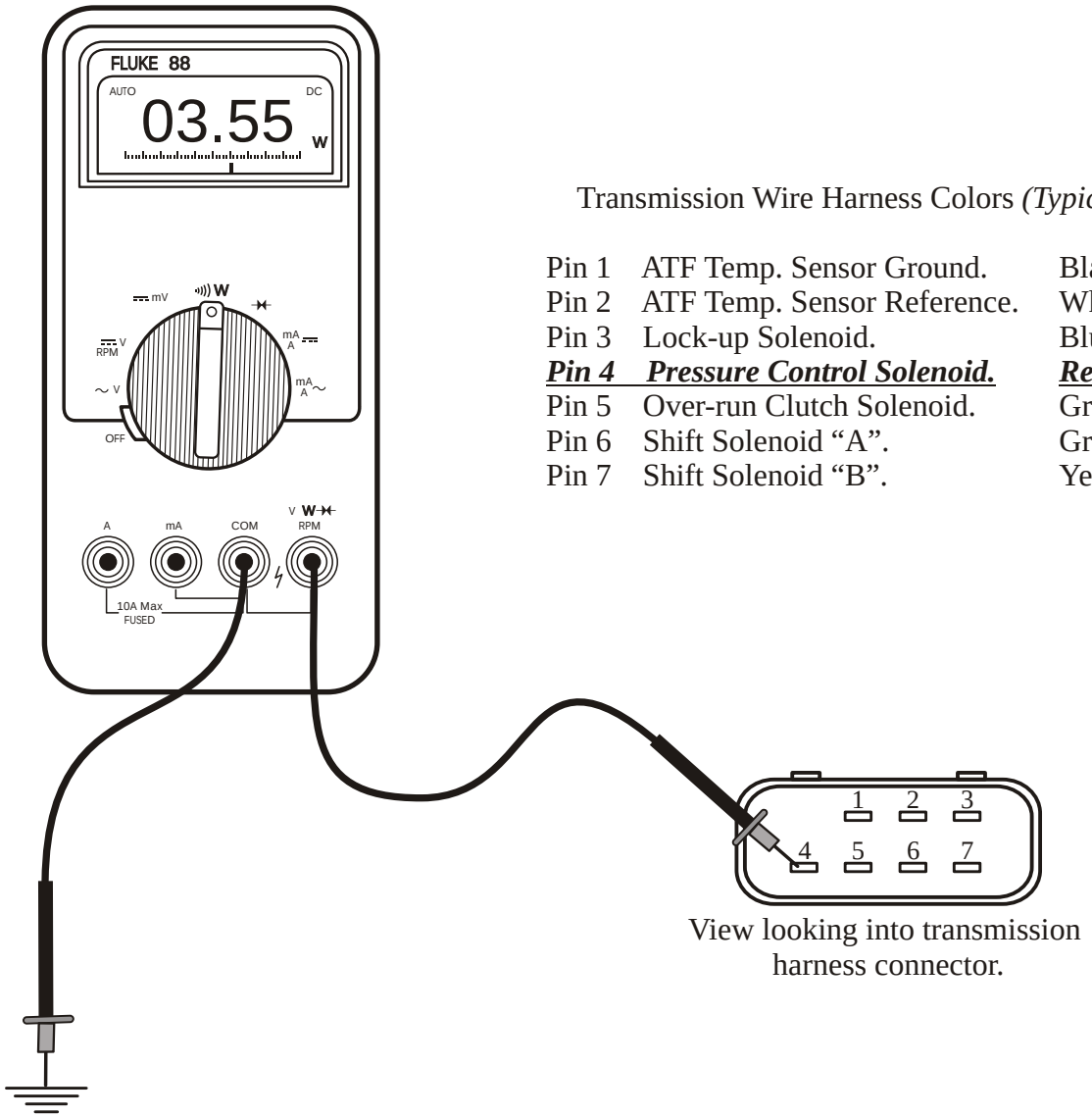
If there is no voltage reading on the wire that comes from the computer to the dropping resistor at pin 1, go to ***Step 4***. If the voltage reading on the wire that comes from the computer to the dropping resistor at pin 1 is correct at closed throttle, but then drops to approximately 5 volts and remains, or is constantly 5 volts, proceed to ***Step 5***. If the voltage is over 5 volts and does not decrease at all with throttle opening, proceed to ***Step 6***.

Step 4: If no voltage is indicated on the meter at pin 1 of the dropping resistor, either the wire coming from the computer to the dropping resistor is shorted to ground, or the wire is open. Refer to ***Figure 5*** for TCM and dropping resistor locations. Refer to ***Figure 6*** for pressure control solenoid circuit diagram and wire colors for various years and models. Refer to ***Figure 7*** for TCM connector pin layout and wire integrity checks for 1995 through 1998 model vehicles. Refer to ***Figure 8*** for TCM connector pin layout and wire integrity checks for 1999 through 2003 models. After locating the computer for the vehicle you are working on, turn the ignition "ON". Use your voltmeter and back-probe terminal 2 at the wire side of the computer harness connector. Measure the voltage at the wire. If no voltage is present, it will be an indication that the wire is shorted to ground, or the computer is faulty. Turn the ignition "OFF". Disconnect the TCM connector and the connector at the dropping resistor. Set your meter to read Ohms and probe terminal 2 at the computer connector again. If resistance is indicated on the meter, the wire is shorted to ground. Locate and repair the short or cut the wire at the TCM and dropping resistor and run a new wire from end to end. If the meter indicates an open circuit, the wire is not shorted. Plug the connector back in at the TCM and dropping resistor. Again turn the ignition "ON" and recheck for voltage. If there is still no voltage present, replace the computer.

Step 5: If the voltage at pin 1 of the dropping resistor is correct at closed throttle then drops to 5 volts and remains, or is constantly at 5 volts, this is an indication of too much resistance or an open in the circuit. The open is either because of a faulty dropping resistor *(even though resistance indicates between 11.2 and 12.8 ohms),* or a problem with the wire from the dropping resistor to the pressure control solenoid. For circuit diagram, refer to ***Figure 6***. Turn the ignition "ON" Using the D.V.O.M. back-probe terminal 1 of the transmission computer harness connector. Check to see if voltage is present. If no voltage is indicated on the meter, the open in the wire is between the dropping resistor and pressure control solenoid. If voltage is seen on the meter, there could be a problem with the transmission case connector, the connector inside the trans at the pressure control solenoid, or a faulty dropping resistor.

Step 6: If the voltage is over 5 volts on both terminals 1 and 2 at the dropping resistor, and the voltage doesn't decrease with throttle opening, the problem could be the wire going to the pressure control solenoid is shorted to power, or the TCM is no good. To determine if the wire is shorted to voltage, locate the TCM (refer to ***Figure 5***). Disconnect the controller connector , (referring to ***Figure 7 and 8*** for the correct model year), and the connector for the dropping resistor. Using a D.V.O.M. Connect the red lead of the meter to terminal 2 and place the black lead to ground. If voltage is present, there is a short to power from the TCM to the dropping resistor. If no voltage is present, check for voltage at terminal 1. If voltage is present the wire from the dropping resistor to the pressure control solenoid is shorted to power. If no voltage is present at both terminals the problem is a faulty TCM.

The pressure control solenoid resistance should measure between 2.5-5 ohms. Disconnect the transmission solenoid harness connector. Place the red lead of your D.V.O.M to terminal 4 in the harness connector. Place the black lead of your D.V.O.M. to a good ground. If resistance is between 2.5-5 ohms, proceed to Step 2. If resistance is below 3 ohms, check the wire in the internal harness for a short to ground. If the wire does not indicate a shorted circuit, replace the pressure control solenoid. If the resistance is over 5 ohms check the wire in the internal harness for an open circuit. Check the connector at the pressure control solenoid for a poor connection. If the connector is good and solidly connected and the wire does not indicate an open circuit, replace the pressure control solenoid.



Transmission Wire Harness Colors *(Typical)*.

Pin 1	ATF Temp. Sensor Ground.	Black wire.
Pin 2	ATF Temp. Sensor Reference.	White wire.
Pin 3	Lock-up Solenoid.	Blue wire.
Pin 4	***Pressure Control Solenoid.***	***Red wire.***
Pin 5	Over-run Clutch Solenoid.	Grey wire.
Pin 6	Shift Solenoid "A".	Green wire.
Pin 7	Shift Solenoid "B".	Yellow wire.

View looking into transmission harness connector.

Figure 1

The dropping resistor should measure between 11.2 and 12.8 ohms. Make certain either the ignition is in the "OFF" position, or remove the negative battery cable. Disconnect the two terminal dropping resistor connector. Place the red lead of the D.V.O.M. to one terminal on the dropping resistor, place the black lead of the D.V.O.M. to the other terminal. If the meter does not indicate a resistance between 11.2 and 12.8 ohms, replace the dropping resistor. If the meter does indicate a resistance between 11.2 and 12.8 ohms, proceed to ***Step 3***.

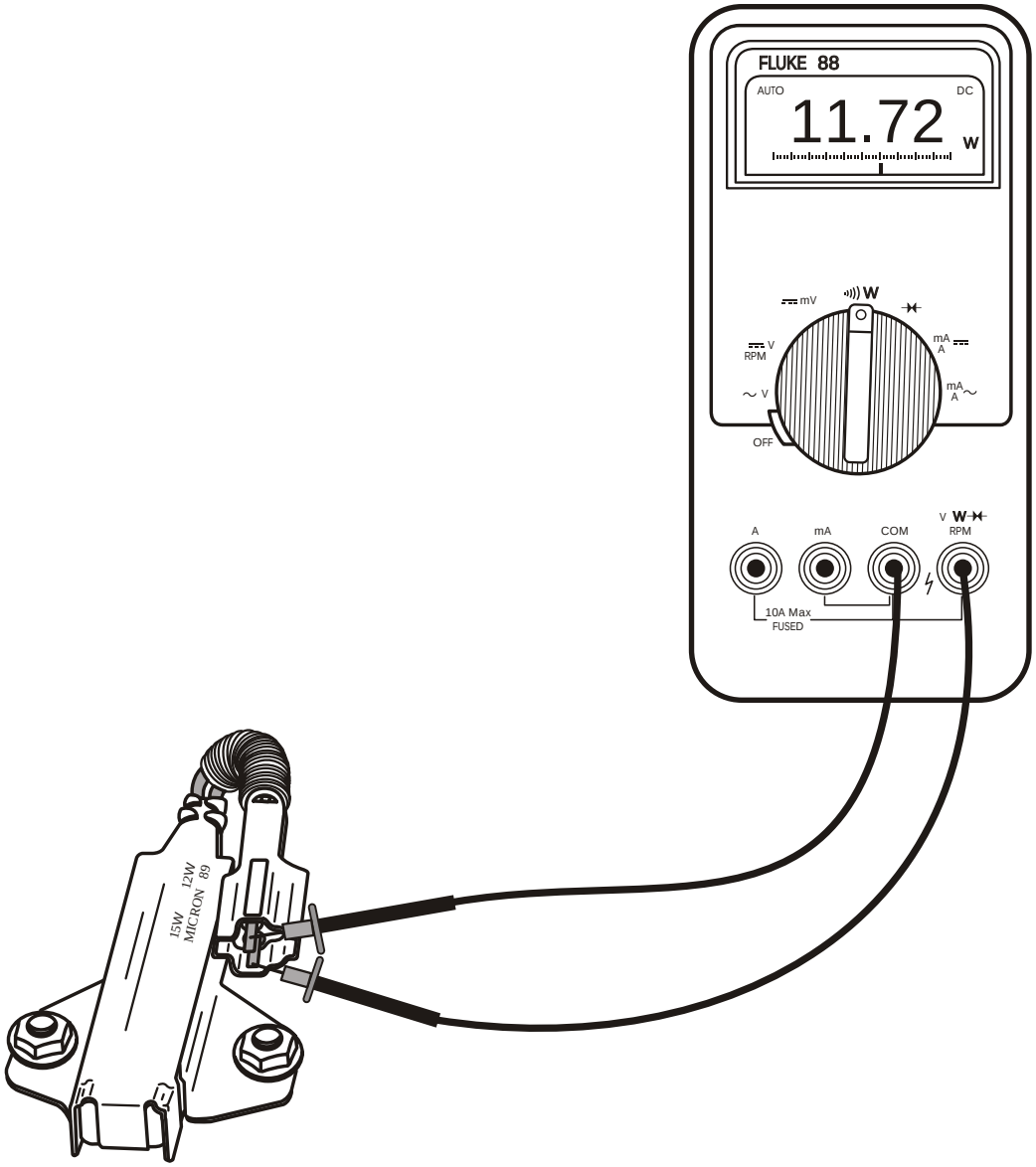


Figure 2

HFT

To check the voltage that comes from the computer to the dropping resistor, make sure the dropping resistor harness is properly connected. Using the red lead of a D.V.O.M. Back-probe the wire at pin 1 of the dropping resistor. Place the black lead of the D.V.O.M. to a good ground, and set the meter to read D.C. volts . Have an assistant get into the car and turn the ignition to the "ON" position. Check the voltage reading. The meter should indicate between approximately 5 to 14 volts. Have your assistant begin depressing the accelerator pedal. The voltage reading on the meter should decrease all the way to full throttle. Once full throttle has been reached, the voltage reading should be approximately .45 volts. If there is no voltage reading on the wire at pin 1, go to ***Step 4***. If the voltage reading at pin 1 is correct at closed throttle, but then drops to approximately 5 volts and remains, or is constantly 5 volts, proceed to ***Step 5***.

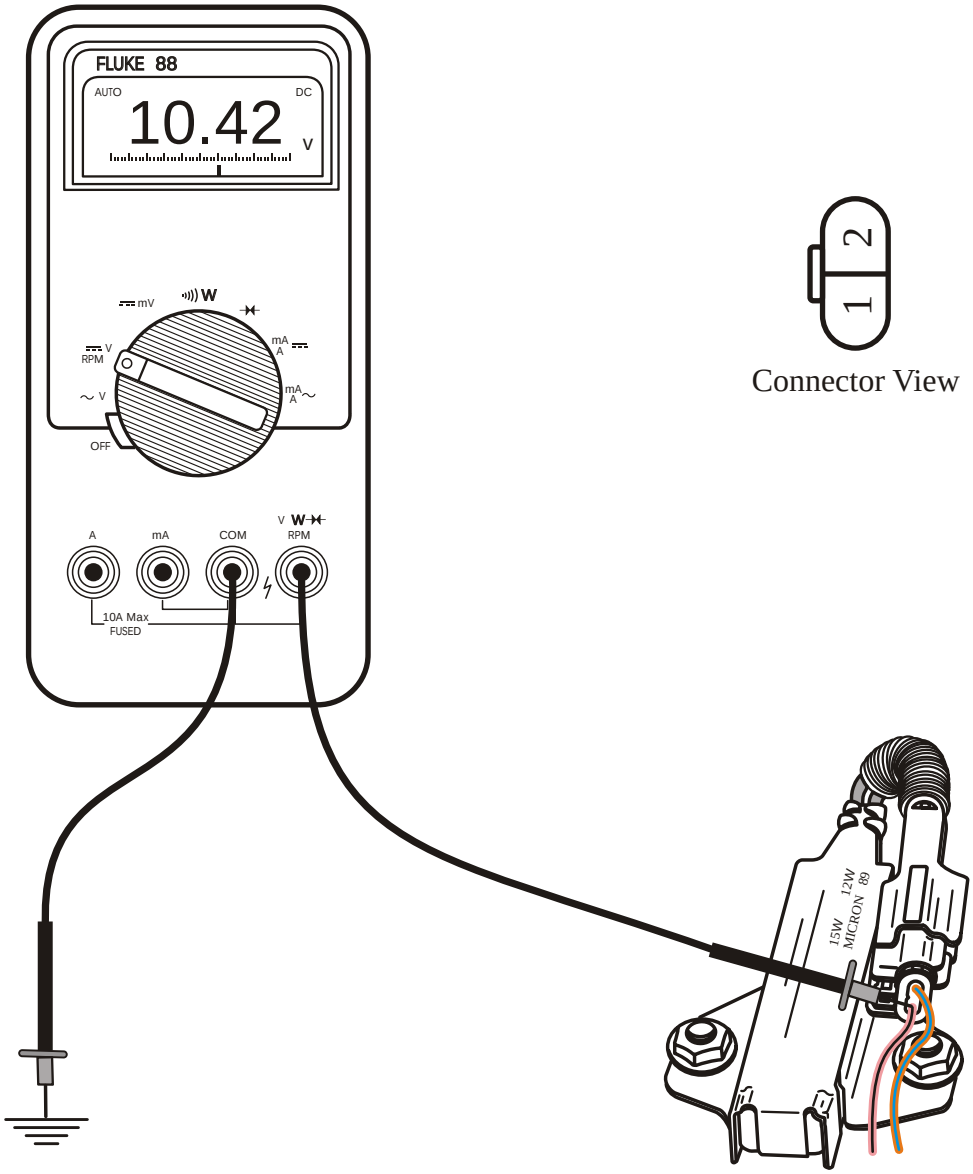


Figure 3

To check the voltage that goes from the dropping resistor to the pressure control solenoid, make sure the dropping resistor harness is properly connected. Using the red lead of a D.V.O.M. back-probe the wire at pin 2 of the dropping resistor. Place the black lead of the D.V.O.M. to a good ground, and set the meter to read D.C. volts . Have an assistant get into the car and turn the ignition to the “ON” position. Check the voltage reading. The meter should indicate between approximately 1.5 and 2.5 volts. Have your assistant begin depressing the accelerator pedal. The voltage reading on the meter should decrease all the way to full throttle. Once full throttle has been reached, the voltage reading should be approximately .45 volts.

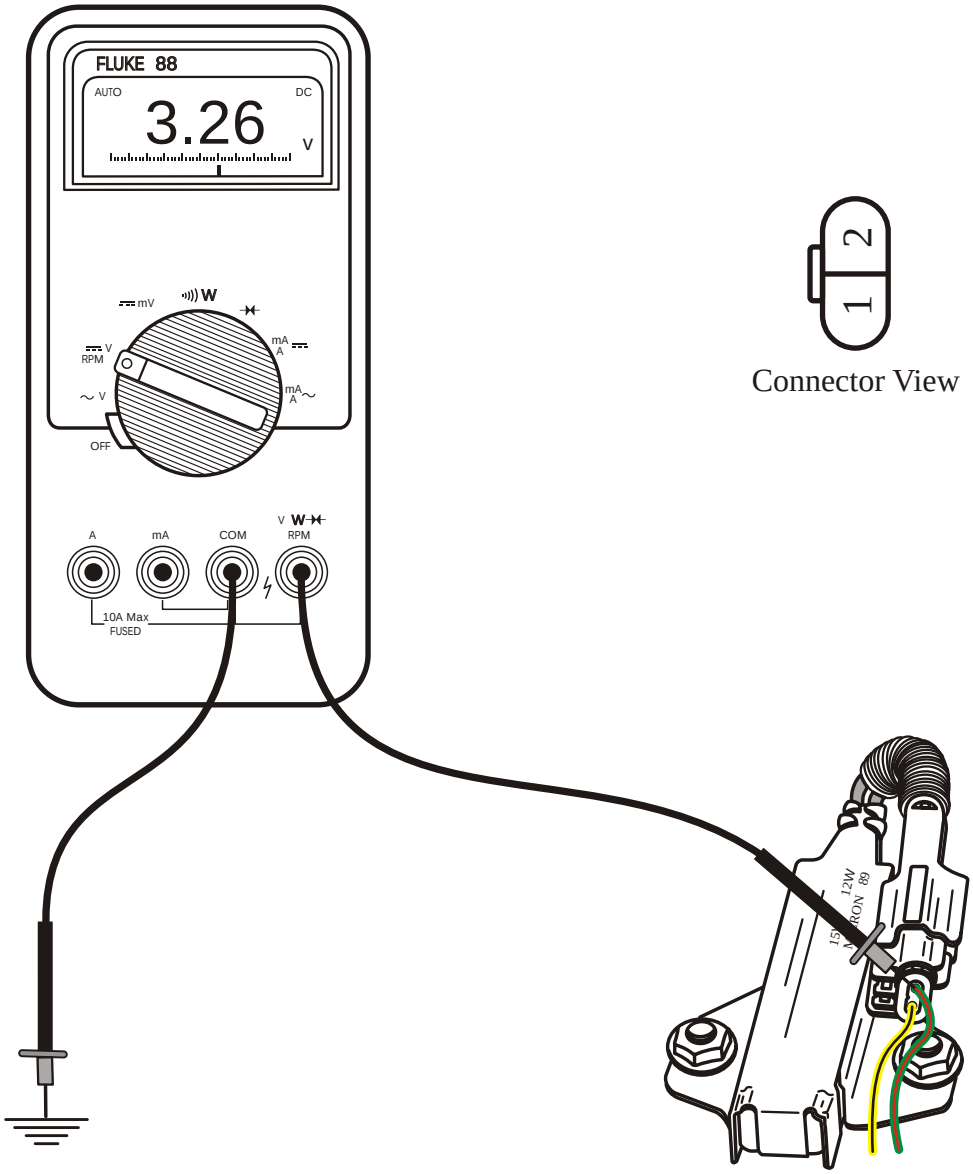


Figure 4

NISSAN/INFINITI TCM AND DROPPING RESISTOR LOCATIONS

MODEL/YEAR	TCM LOCATION	DROPPING RESISTOR LOCATION
1995-97 ALTIMA	Behind passenger kick panel	Driver side shock tower
1998-01 ALTIMA	Under front of center console	Driver side shock tower
2001-2003 ALTIMA	Behind right side of glove box to right of ECM	Driver side shock tower near brake reservoir
1995-03 MAXIMA	Center of dash under console	Driver side fender well below air cleaner
1996-02 QUEST/VILLAGER	Under dash right side of steering column	Driver side fender well behind plastic wheel liner *wheel liner removal required*
1995-96 G20	Behind driver side kick panel	Below air cleaner
1999-02 G20	Behind lower center of dash, forward of selector lever	Behind driver side shock tower
1995-96 I30	Behind driver side kick panel	Driver side fender well below air cleaner
1997-01 I30	Below center of dash, under Body Control Module or ASCD Module	Driver side fender well below air cleaner
2001-03 I35	Below center of dash, under Body Control Module or ASCD Module	Driver side fender well below air cleaner

Figure 5

NISSAN/INFINITI
WIRE COLORS BY MODEL

MODEL/YEAR	TCM TO RESISTOR	RESISTOR TO PRESSURE SOLENOID
1995-97 ALTIMA	Pink/Black	Orange/Blue
1998-01 ALTIMA	Pink/Black	Red/White
2001-2003 ALTIMA	White/Black	Green/Red
1995-03 MAXIMA	White/Black	Green/Red
1996-02 QUEST/VILLAGER	Yellow/Black	Green/Red
1995-96 G20	White	Blue
1999-02 G20	Pink/Black	Red/White
I30/I35 All Models	White/Black	Green/Red

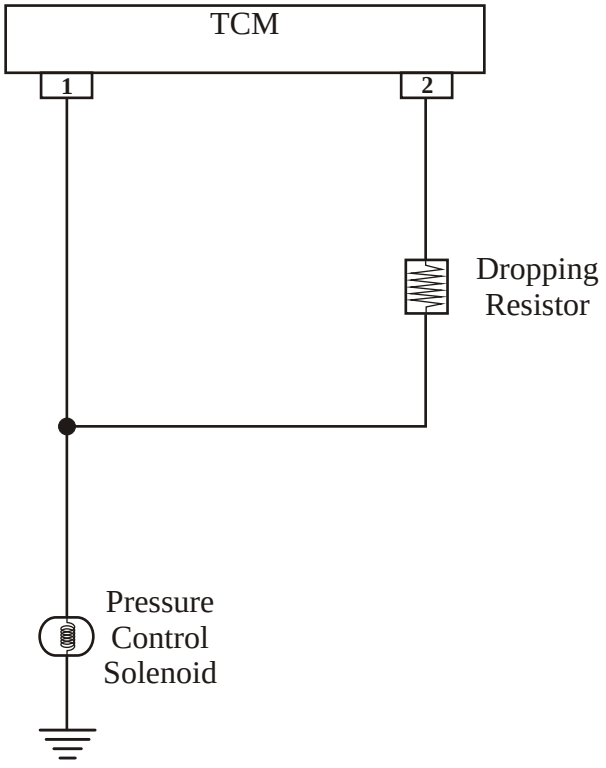


Figure 6

1995 - 1998 TCM CONNECTOR VIEW
ALL MODELS

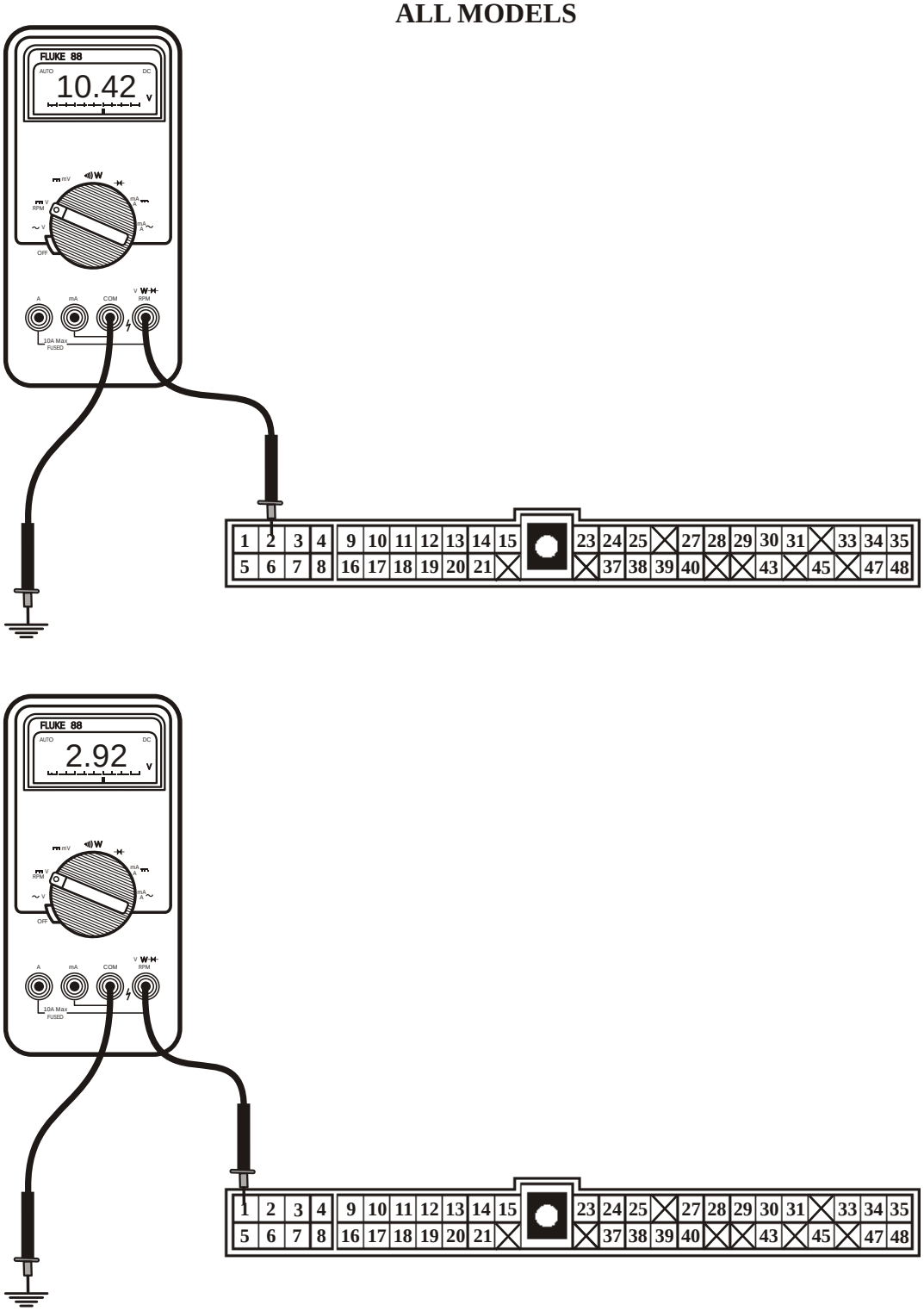


Figure 7

1999 - 2003 TCM CONNECTOR VIEW
ALL MODELS

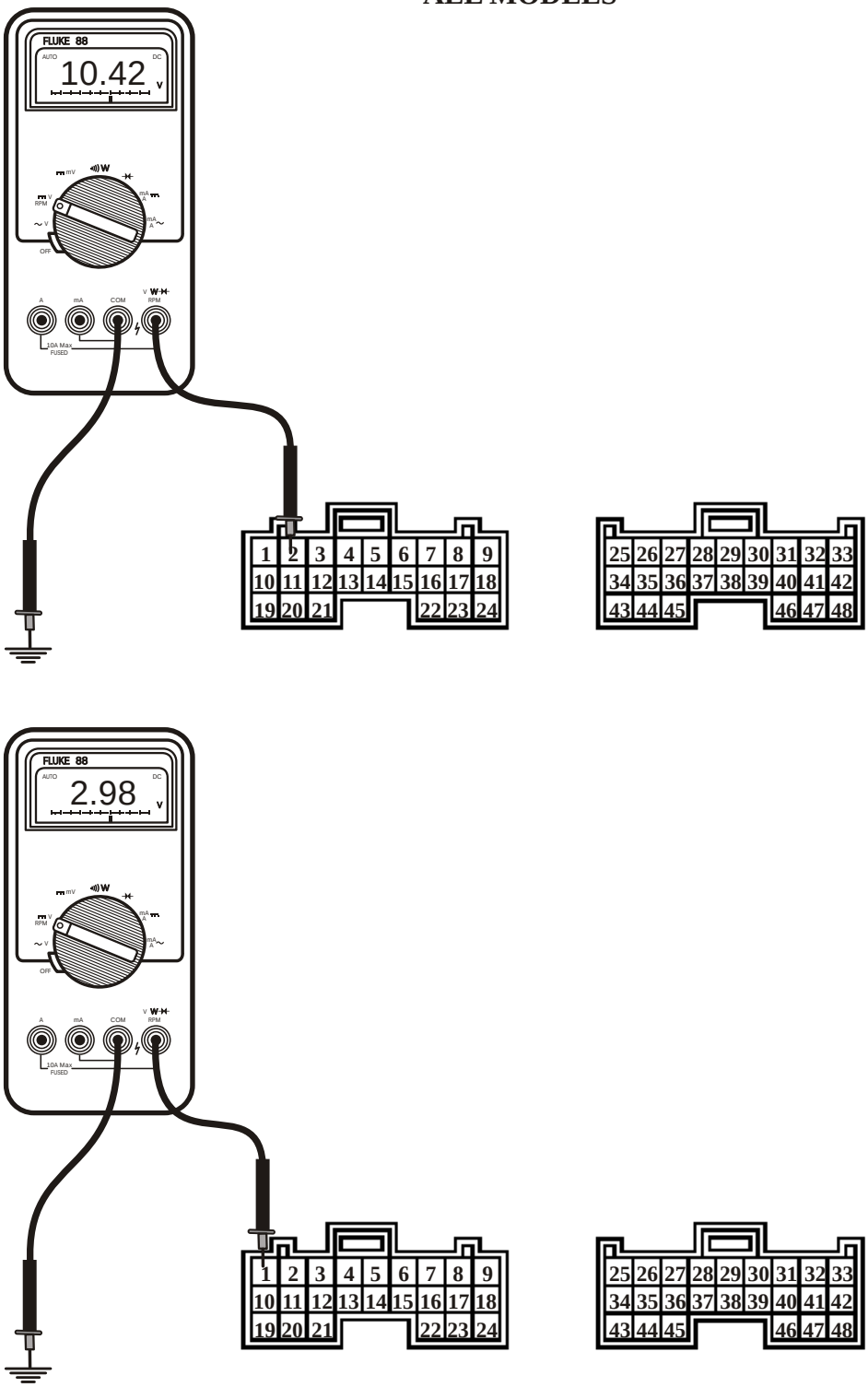


Figure 8

Sonnax

2000 ISUZU TROOPER & BMW
4L30-E
D.T.C. P1870 OR TCC SHUDDER

COMPLAINT: 2000 and up Isuzu Trooper and BMW models with the 4L30-E transmission may exhibit a Diagnostic Trouble Code P1870 Torque Converter Slip or a shudder on Torque Converter Clutch application.

CAUSE: The Cause may be, a worn Torque Converter Regulator Valve and Sleeve, creating insufficient converter apply pressure to hold the clutch on. See Figure 1.
2000 and up model Trooper and BMW applications have a Pulse Width Modulated Converter application. This TCC application strategy change, required a new TCC PWM solenoid and numerous casting changes to the pump and it's related parts.
See Figure 3 for the ON-OFF two valve pump that is still used on 2000 and up Cadillac Catera, Rodeo and Passport models.
See Figure 2 for the PWM pump with the identification of the new valves and their locations.
See Figure 4 for the differences in the worm track configuration of the ON-OFF pump casting and the PWM pump casting.
See Figure 5 for the differences in the hole configuration between the pump plates.
See Figure 6 for the differences in the worm track configuration of the Bell Housings.
See Figure 7 for a partial hydraulic schematic of the PWM Torque Convertor Clutch apply circuit.

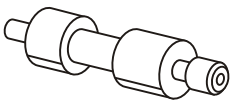
CORRECTION: Replace the Torque Converter Regulator Valve and Sleeve.

SERVICE INFORMATION:

TORQUE CONVERTER REGULATOR VALVE (Isuzu).....8-96018-518-0
TORQUE CONVERTER REGULATOR VALVE SLEEVE (Isuzu).....8-96018-472-0

TORQUE CONVERTER REGULATOR VALVE AND SLEEVE

Special thanks to:
Ted's Transmission
Alex Biliski at
Santilli's Transmission
Glenside Pa.
Dynamic Dino
John Forrester



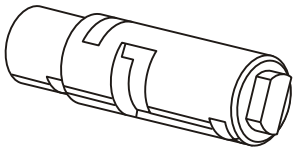
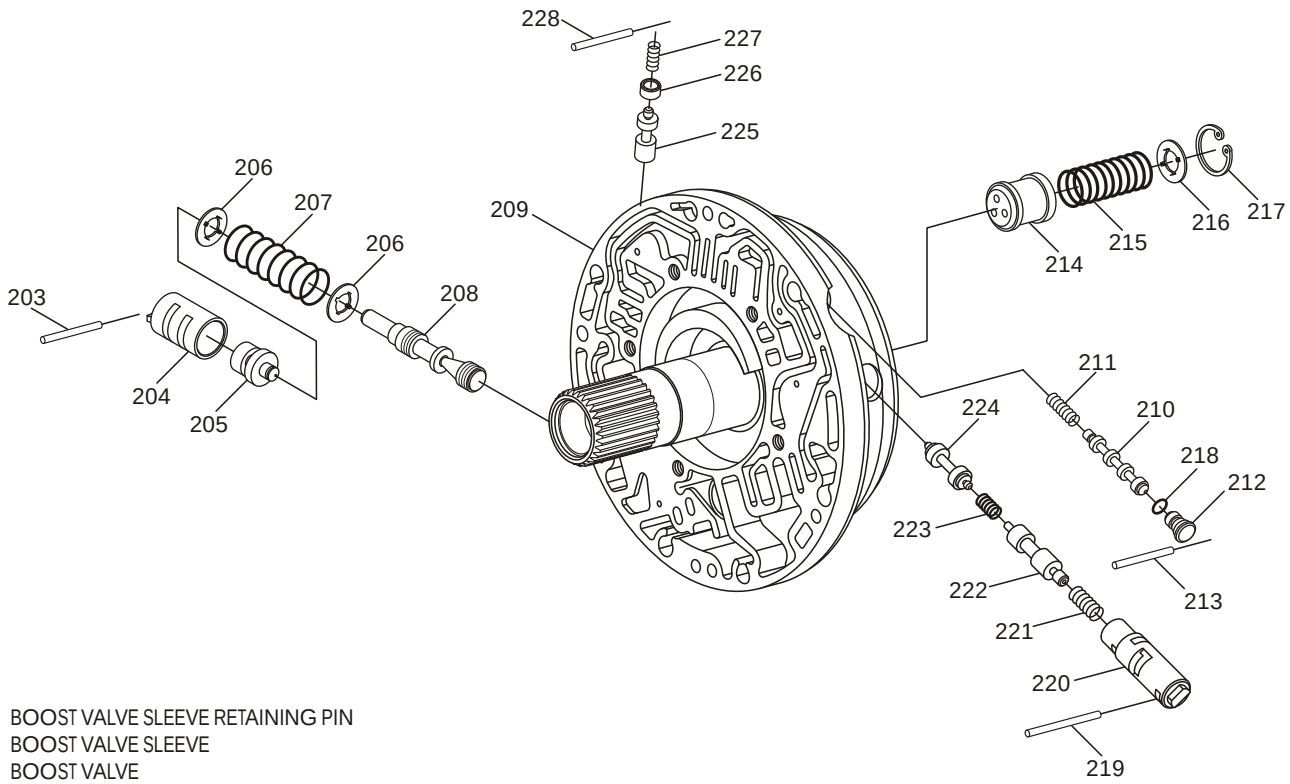


Figure 1

EXPLODED VIEW
"4 VALVE PUMP"



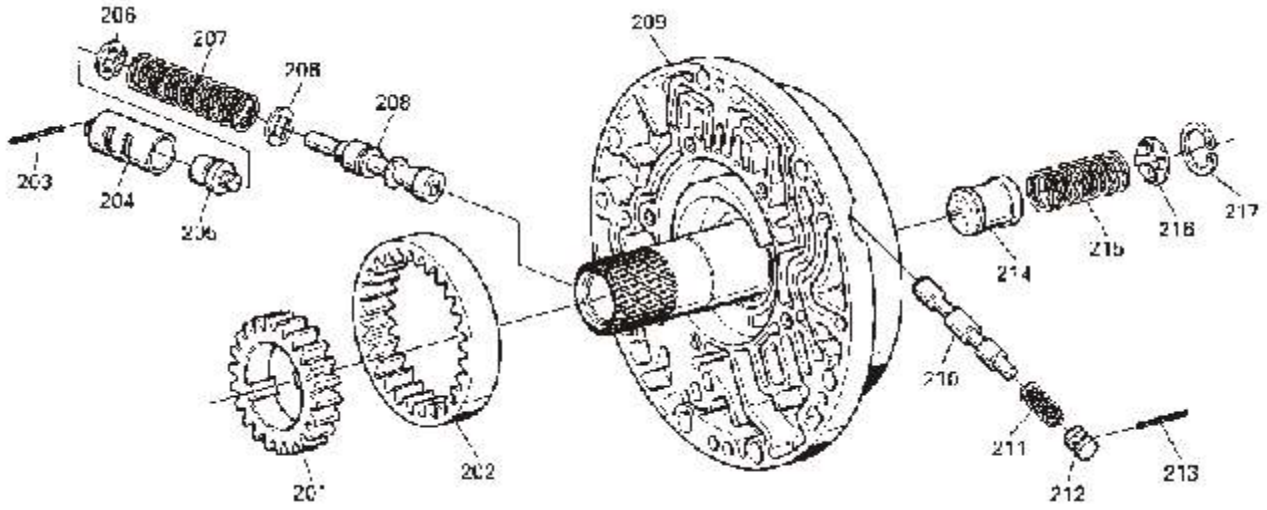
203 BOOST VALVE SLEEVE RETAINING PIN
204 BOOST VALVE SLEEVE
205 BOOST VALVE
206 PRESSURE REGULATOR VALVE SPRING SEAT (2)
207 PRESSURE REGULATOR VALVE SPRING
208 PRESSURE REGULATOR VALVE
209 OIL PUMP ASSEMBLY
210 CONVERTER CLUTCH CONTROL VALVE
211 CONVERTER CLUTCH CONTROL VALVE SPRING
212 CONVERTER CLUTCH CONTROL VALVE BORE PLUG
213 TCC CONTROL VALVE BORE PLUG RETAINING PIN
214 THROTTLE SIGNAL ACCUMULATOR PISTON
215 THROTTLE SIGNAL ACCUMULATOR PISTON SPRING
216 THROTTLE SIGNAL ACCUMULATOR SPRING SEAT
217 THROTTLE SIGNAL ACCUMULATOR SNAP RING
218 TCC CONTROL VALVE BORE PLUG "O" RING
219 TCC REGULATOR VALVE SLEEVE RETAINING PIN
220 TCC REGULATOR VALVE SLEEVE
221 TCC REGULATOR VALVE SPRING
222 TCC REGULATOR VALVE
223 TCC ISOLATOR VALVE SPRING
224 TCC ISOLATOR VALVE
225 TCC ENABLE VALVE
226 TCC ENABLE VALVE SLEEVE
227 TCC ENABLE VALVE SPRING
228 TCC ENABLE VALVE RETAINING PIN

NOTE: Some valve nomenclature is ATSG interpretations by valve function. Some manuals list all of the TCC related valves the same name.

Figure 2

SPX

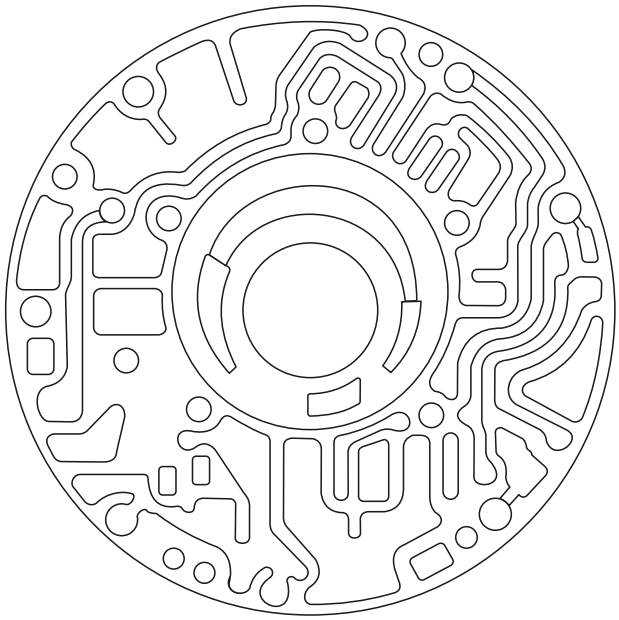
EXPLODED VIEW
"2 VALVE PUMP"



201 OIL PUMP DRIVE GEAR
202 OIL PUMP DRIVEN GEAR
203 BOOST VALVE SLEEVE RETAINING PIN
204 BOOST VALVE SLEEVE
205 BOOST VALVE
206 PRESSURE REGULATOR VALVE SPRING SEAT (2)
207 PRESSURE REGULATOR VALVE SPRING
208 PRESSURE REGULATOR VALVE
209 OIL PUMP ASSEMBLY
210 CONVERTER CLUTCH CONTROL VALVE
211 CONVERTER CLUTCH CONTROL VALVE SPRING
212 CONVERTER CLUTCH CONTROL VALVE BORE PLUG
213 TCC CONTROL VALVE BORE PLUG RETAINING PIN
214 THROTTLE SIGNAL ACCUMULATOR PISTON
215 THROTTLE SIGNAL ACCUMULATOR PISTON SPRING
216 THROTTLE SIGNAL ACCUMULATOR SPRING SEAT
217 THROTTLE SIGNAL ACCUMULATOR SNAP RING

Figure 3

OIL PUMP WORM TRACK
"2 VALVE PUMP"



OIL PUMP WORM TRACK
"4 VALVE PUMP"

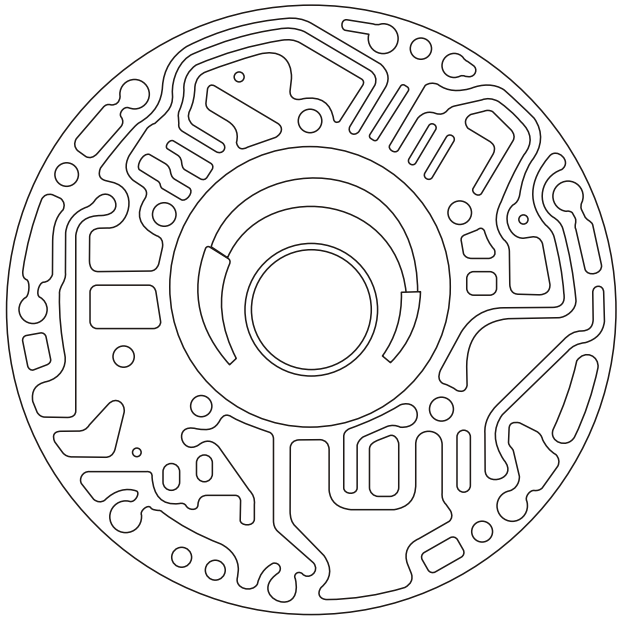
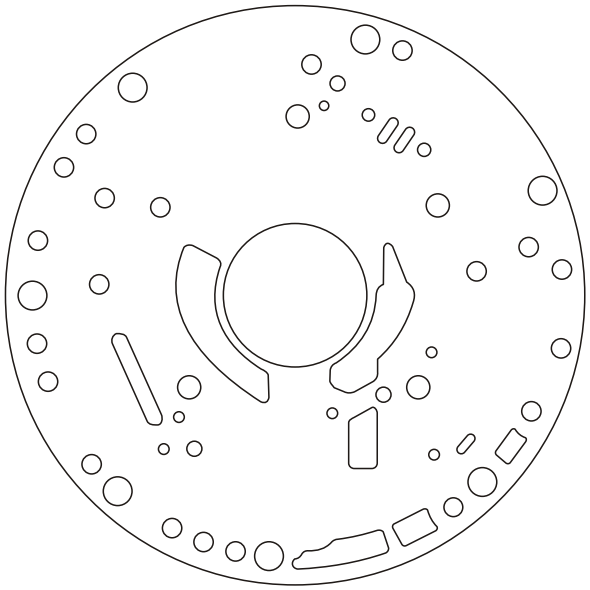


Figure 4

PUMP WEAR PLATE
"2 VALVE PUMP"



PUMP WEAR PLATE
"4 VALVE PUMP"

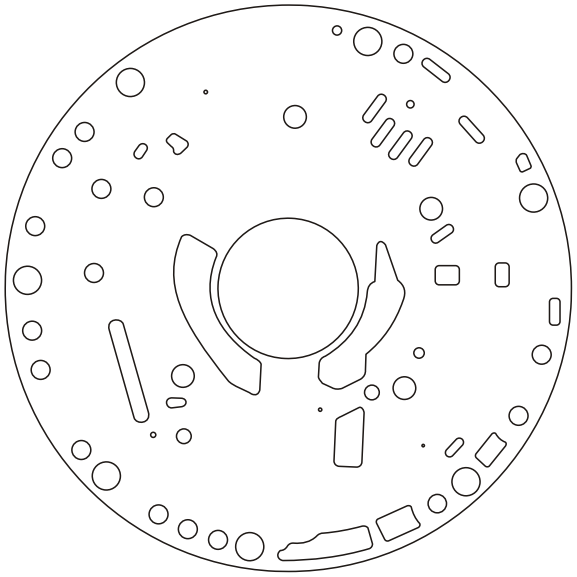


Figure 5

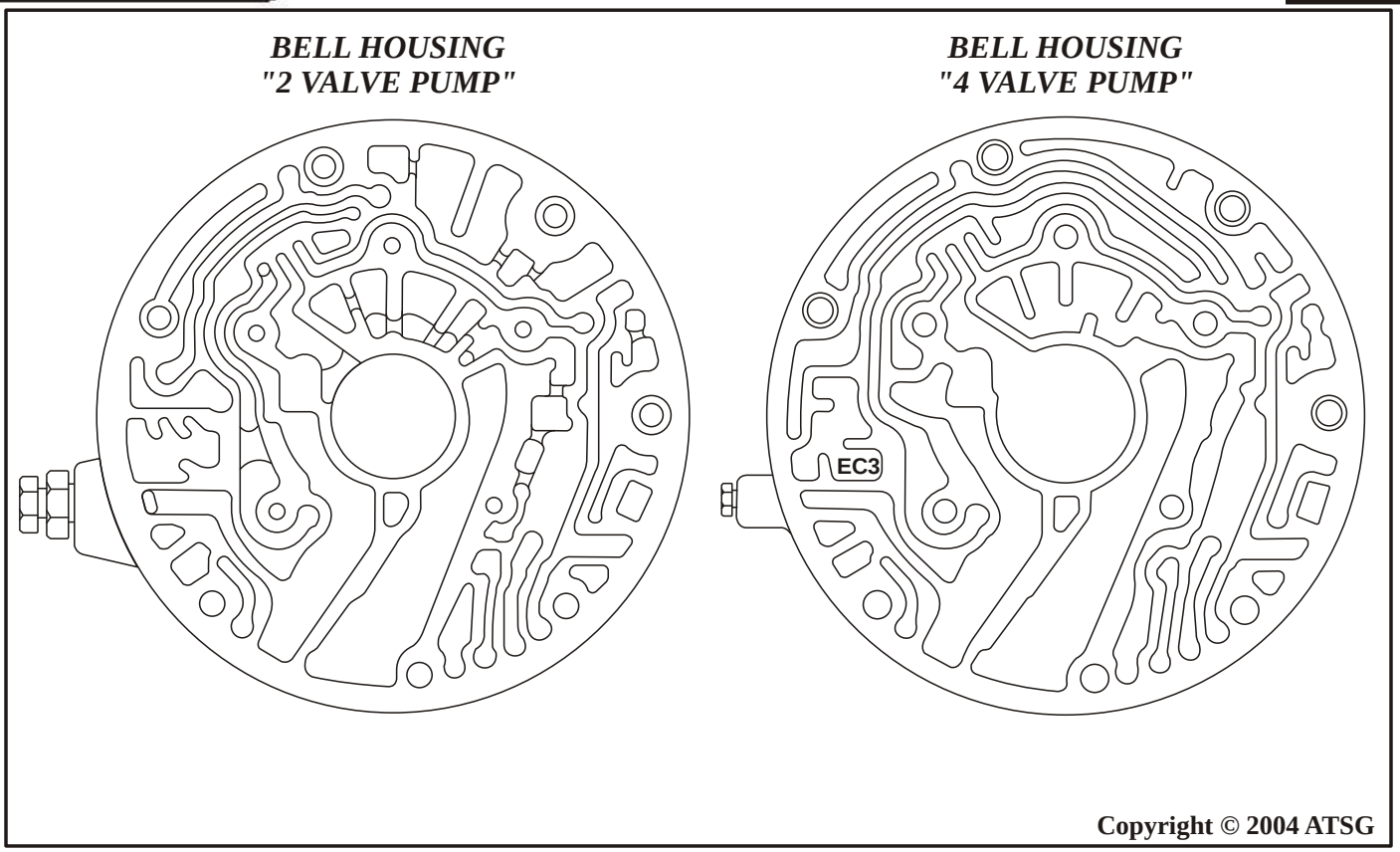
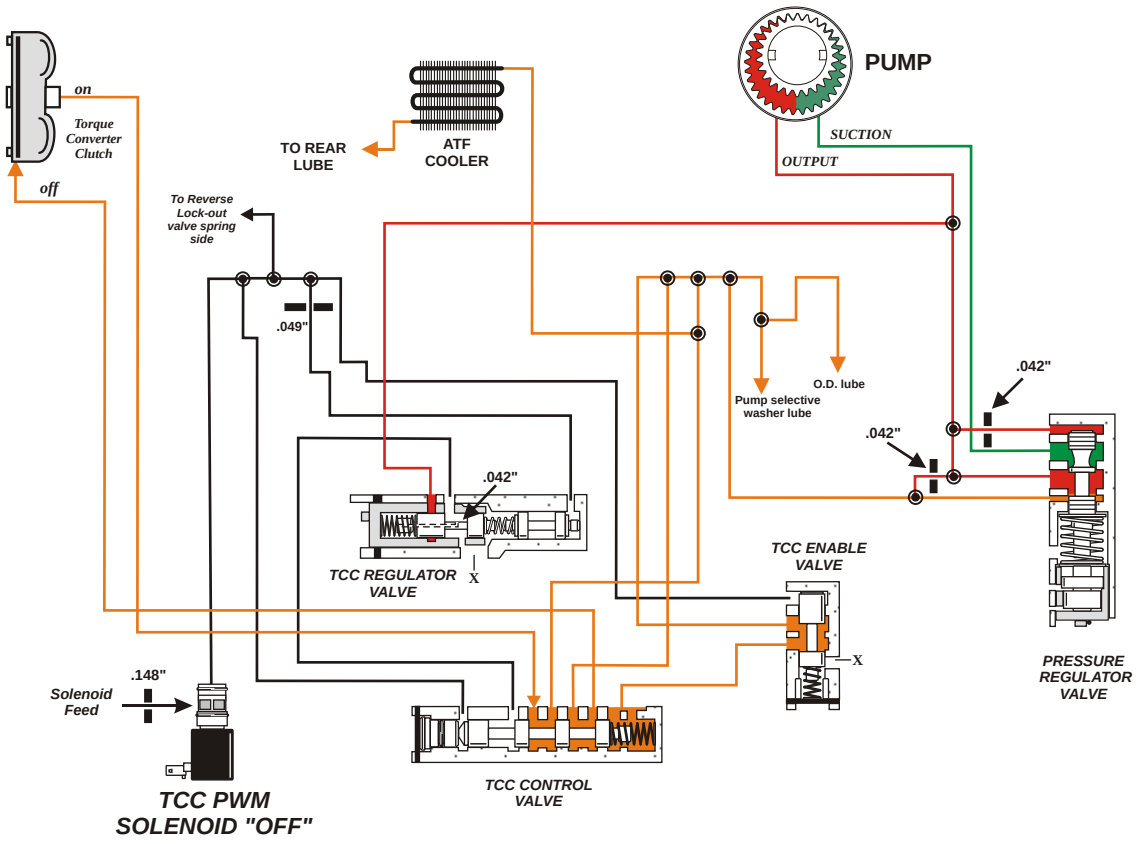

BELL HOUSING
"2 VALVE PUMP"
BELL HOUSING
"4 VALVE PUMP"
EC3
Copyright © 2004 ATSG

Figure 6

PWM TCC "OFF" PARTIAL SCHEMATIC



PWM TCC "ON" PARTIAL SCHEMATIC

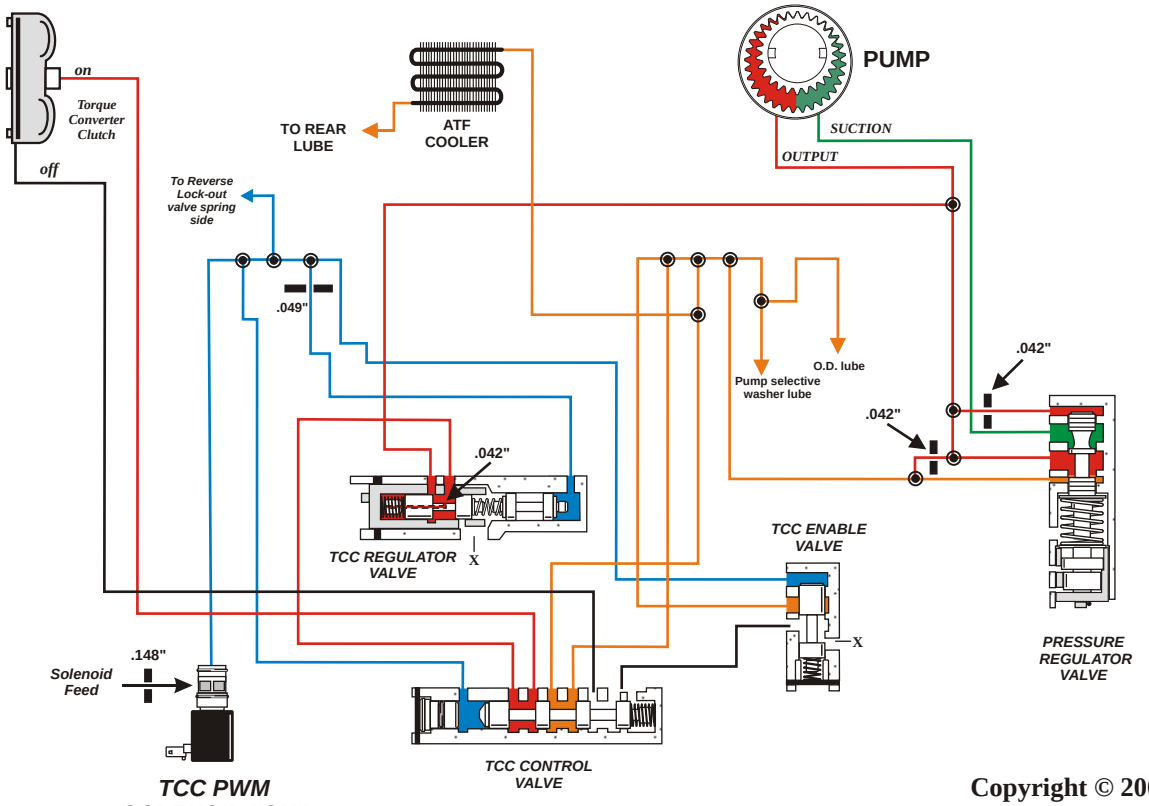


Figure 7

JF506-E
2-3 FLARE OR SLIPS IN 3rd, 4th AND 5th

COMPLAINT: Vehicles equipped with the JF506-E may exhibit a complaint of a flared 2-3 upshift, or slips in 3rd, 4th and 5th.

CAUSE: The cause may be, a cracked High and Reverse clutch piston housing as shown in Figure 1. This crack is extremely difficult to see, and if missed will cause premature High clutch failure. When this piston is cracked it allows the High clutch to bleed into the Reverse clutch circuit when in 3rd, 4th and 5th gear, which is an exhaust.

CORRECTION: Replace the High and Reverse clutch piston housing as shown in Figure 1. Refer to Figure 2 for an exploded view of the High and Reverse Drum for the piston location.

SERVICE INFORMATION:

HIGH AND REVERSE CLUTCH PISTON HOUSING (Mazda part no.).....FP03-19-480
Note: This piston has also worked on Rover Freelander applications. This piston is not sold separate from the complete drum assembly on most applications.

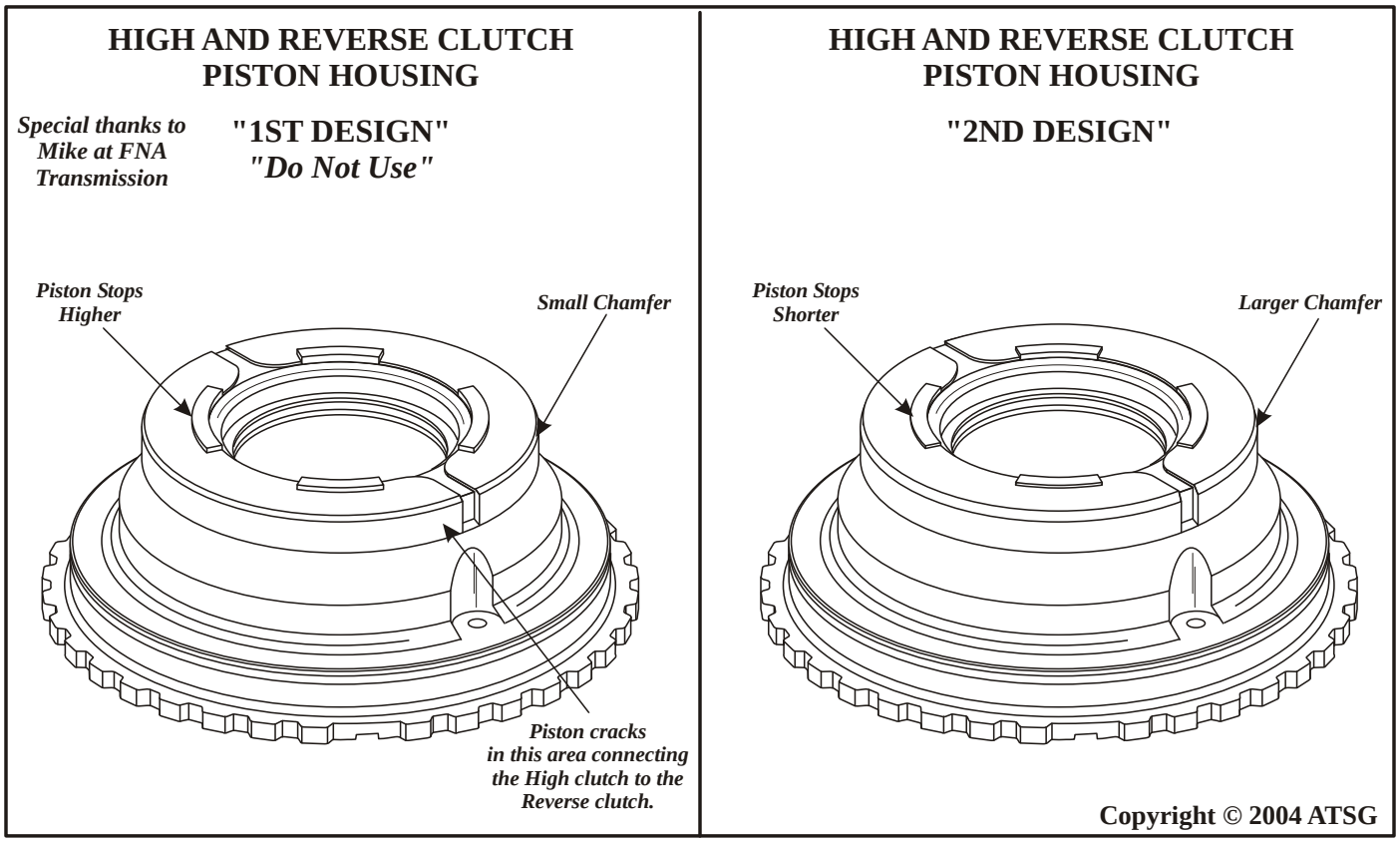
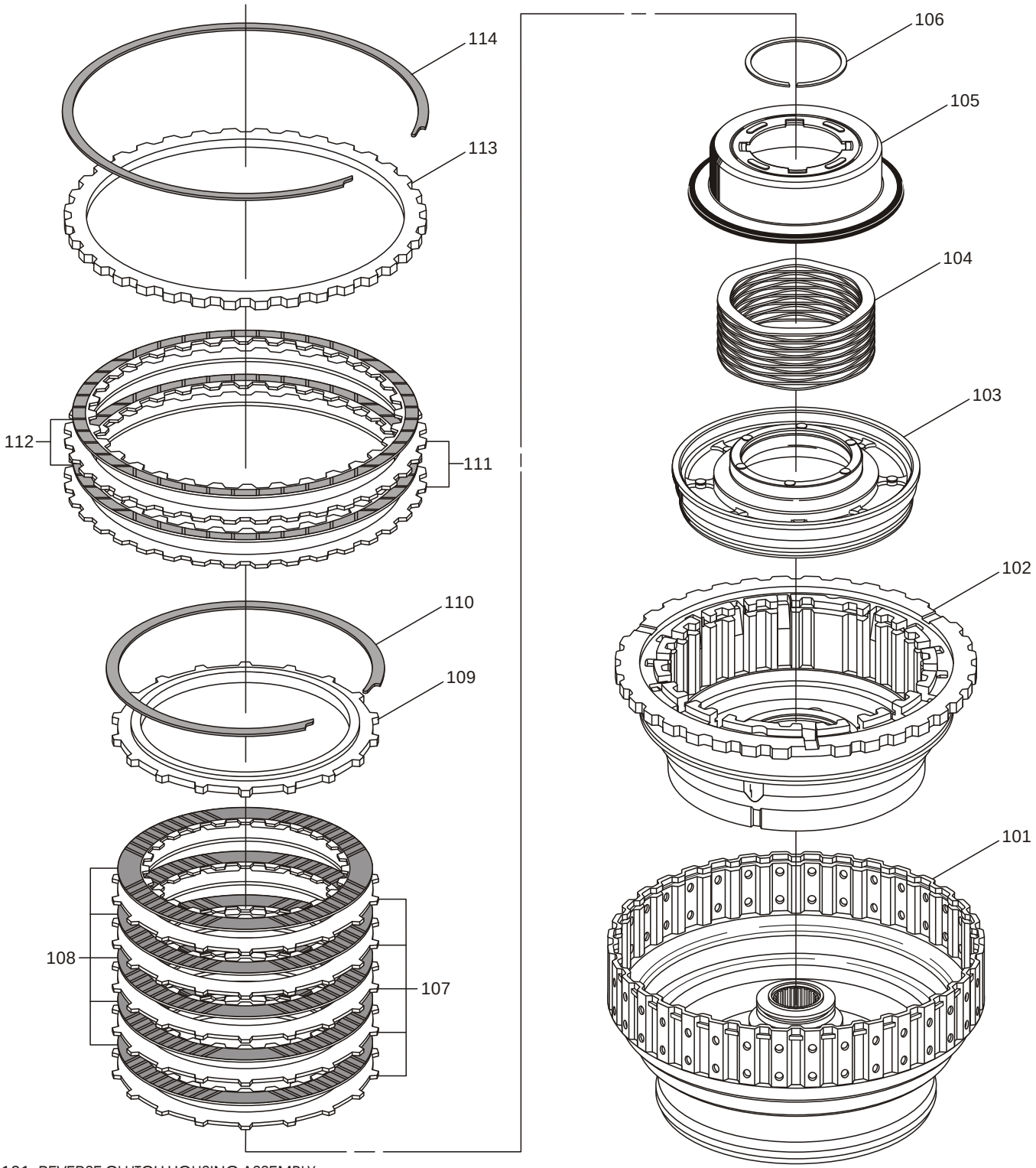


Figure 1



101 REVERSE CLUTCH HOUSING ASSEMBLY
102 HIGH CLUTCH HOUSING/REVERSE PISTON ASSEMBLY
103 HIGH CLUTCH PISTON
104 HIGH CLUTCH PISTON RETURN SPRING
105 HIGH CLUTCH BALANCE PISTON
106 HIGH CLUTCH BALANCE PISTON SNAP RING
107 HIGH CLUTCH STEEL PLATES
108 HIGH CLUTCH FRICTION PLATES
109 HIGH CLUTCH BACKING PLATE
110 HIGH CLUTCH BACKING PLATE SNAP RING
111 REVERSE CLUTCH STEEL PLATES
112 REVERSE CLUTCH FRICTION PLATES
113 REVERSE CLUTCH BACKING PLATE
114 REVERSE CLUTCH BACKING PLATE SNAP RING

Figure 2

KIA

ERRONEOUS DTC's

COMPLAINT: Kia vehicles such as the Sephia, Rio or Spectra may produce gear ratio codes (P0731, 32, 33 and/or 34), transmission range signal malfunction (P0705) and/or converter clutch malfunction code (P0740) without observing incorrect data or experiencing any malfunction.

CAUSE: Prior to 10/18/00, certain driving conditions would prompt the computer to produce these codes. The TCM in vehicles built after 10/18/00 utilizes a revised diagnostic routine which de-sensitized the setting of these codes.

CORRECTION: The TCM did not receive a part number change when this new TCM logic was implemented. Check the production date of the vehicle. If October 18, 2000 or later is the production date of the vehicle, the updated TCM should be in the vehicle. It is possible that the TCM may have been previously exchanged with an earlier version. If there is any doubt, locate and remove the TCM under the dash and to the left of the steering column. On the TCM is a white label with the word Bosch written in the upper left corner (See Figure 1). To the right it says "Made in Korea." Underneath those words is a 6 digit number which provides the build date. The year, then the month and then the day is displayed. The example in Figure 9 is May 30, 2001. October 18, 2000 would appear as 001018. Any TCM built before this date will need to be updated.

The Inhibitor Switch may also need to be replaced. It was updated November 22, 2001 and will have a stamping on the side of the switch with the same dating sequence as on the TCM, i.e.; 011122. If the Inhibitor Switch has an earlier date, replacement with a new switch is recommended Figure 2 provides a continuity check chart for the Inhibitor Switch as well as an electrical wire diagram in the event further testing is required.

SERVICE INFORMATION:

Sephia TCM*.....*0K2AB 18 9E0B
Spectra TCM*.....*0K2AB 18 9E0B
Rio TCM*.....*0K32B 18 9E0

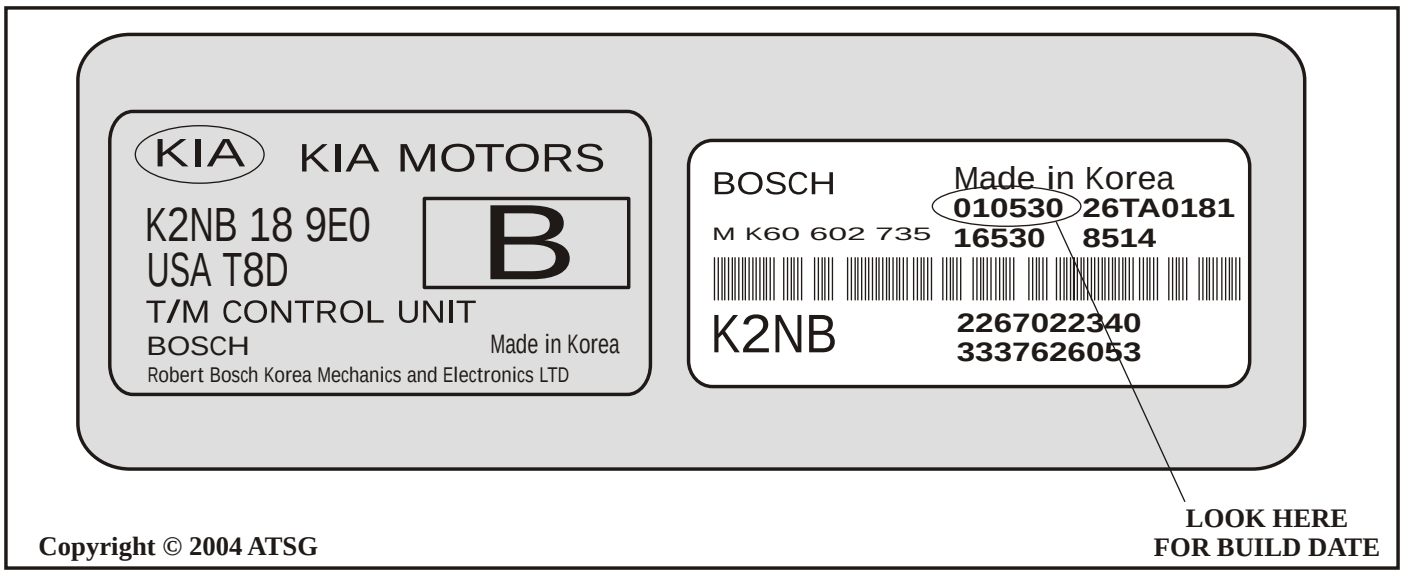
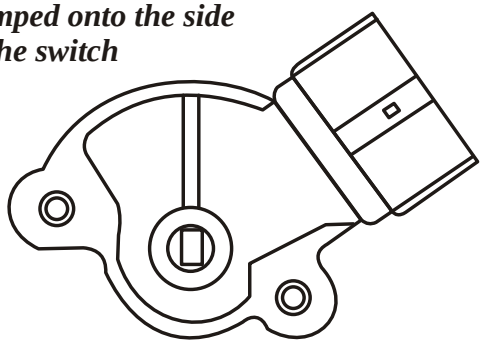
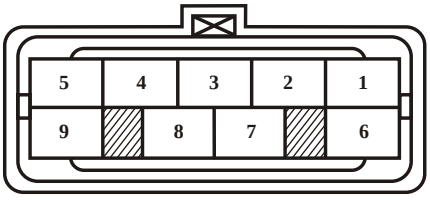


Figure 1

ERRONEOUS DTC's

Check for build date stamped onto the side of the switch





Inhibitor Switch Terminal ID

Position / Range	Connector Terminal 5	4	3	2	1	9	8	7	6
PARK	●				○				
						●			○
R	●			○					
N	●							○	
						●			○
D	●	○							
2	●						○		
1	●		○						

Continuity Check Chart

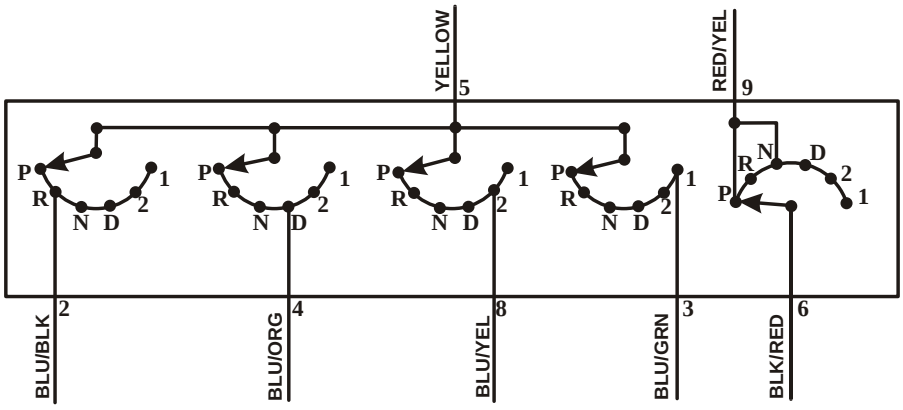
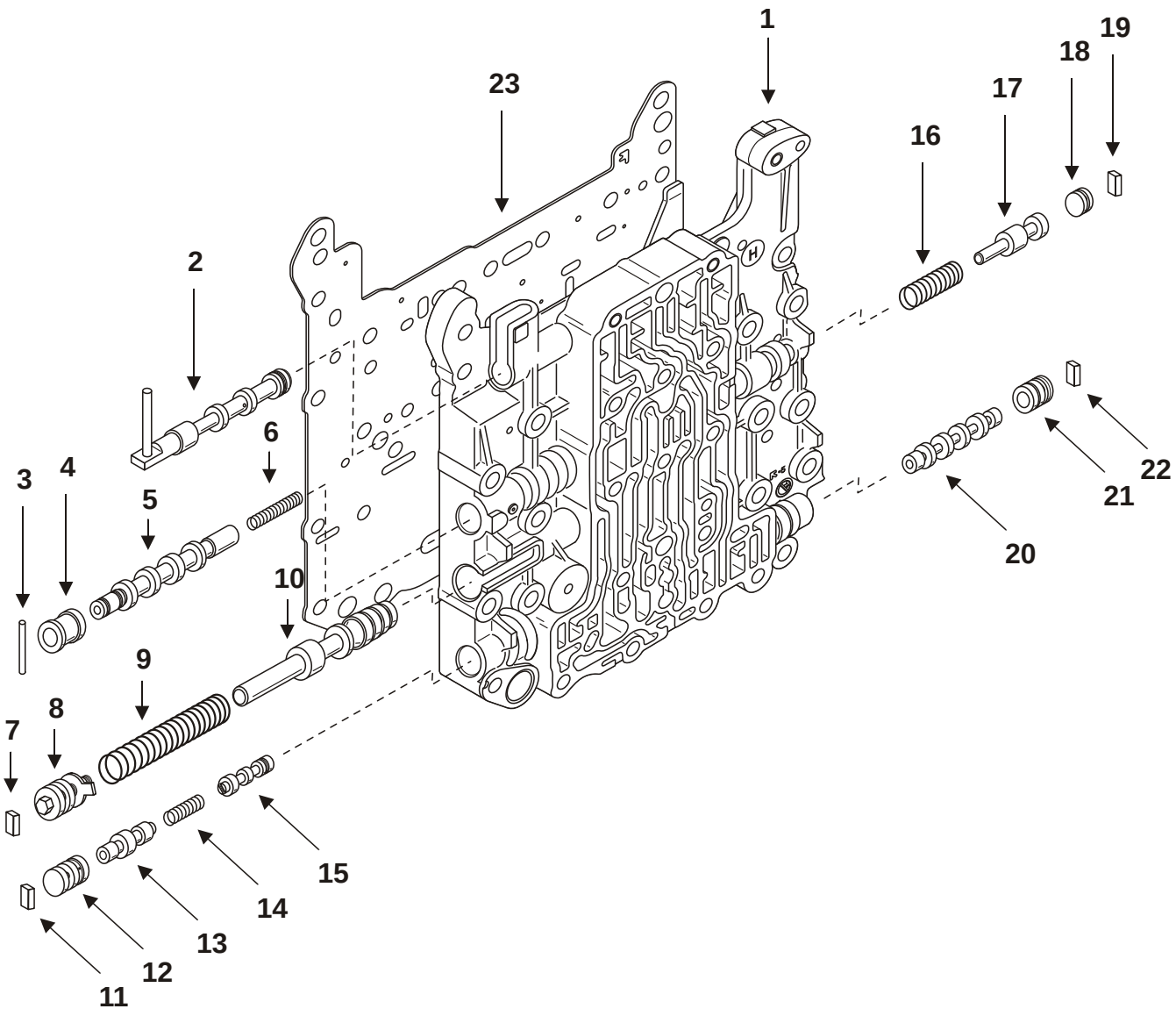


Figure 2

MITSUBISHI F4A41/F4A51
VALVE BODY EXPLODED VIEWS AND IDENTIFICATION OF COMPONENTS

Refer to Figure 1 for valve identification and locations for the Inner Valve Body.
Refer to Figure 2 for valve identification and locations for the Outer Valve Body.
Refer to Figure 3 for Solenoid identification and locations.
Refer to Figure 4 for Check ball, retainer and small parts locations.

INNER VALVE BODY

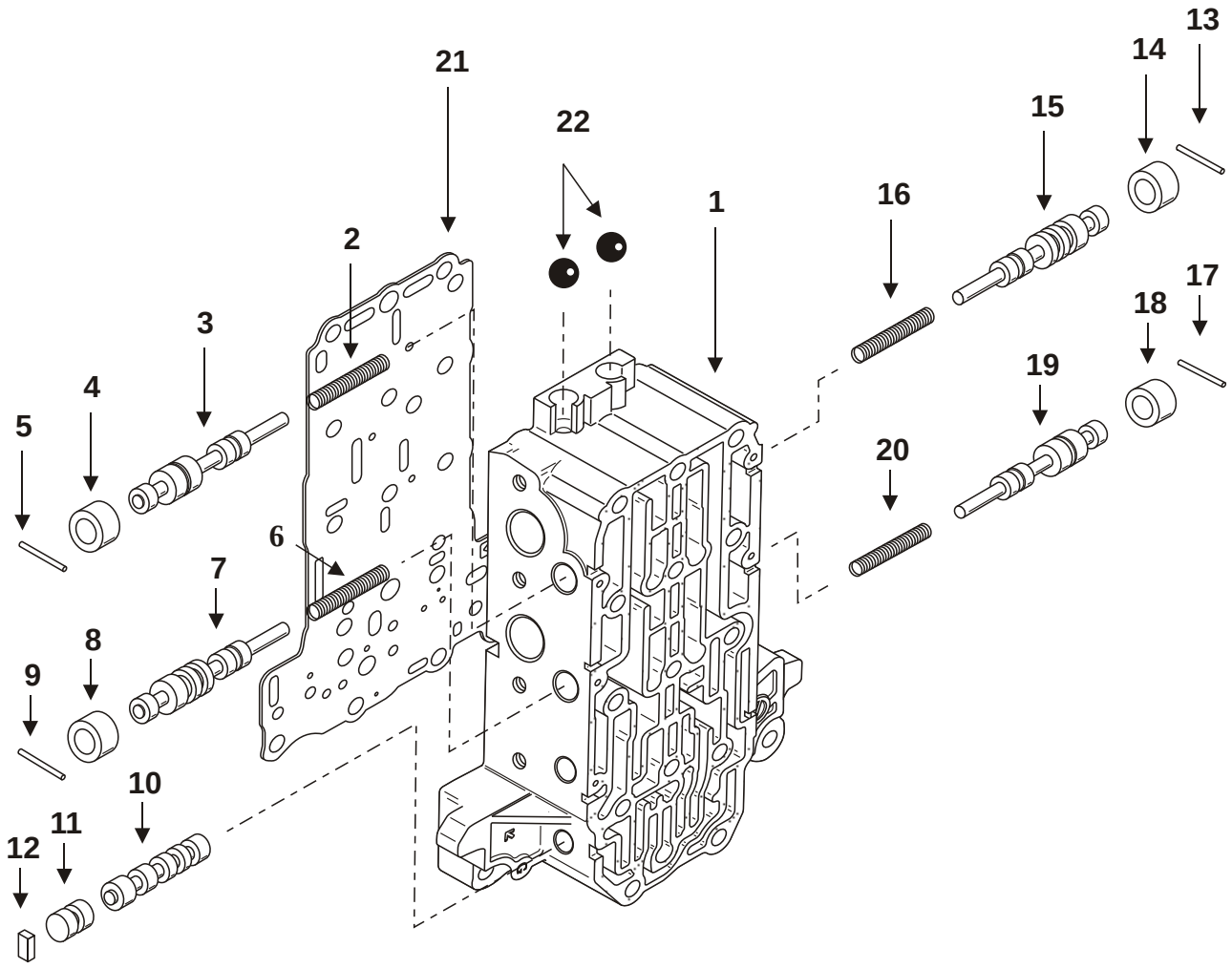


1. INNER VALVE BODY ASSEMBLY
2. MANUAL VALVE
3. ROLL PIN
4. TORQUE CONVERTER CLUTCH CONTROL VALVE SLEEVE
5. TORQUE CONVERTER CLUTCH CONTROL VALVE
6. TORQUE CONVERTER CLUTCH CONTROL VALVE SPRING
7. RETAINER
8. PRESSURE REGULATOR ADJUSTMENT SCREW
9. PRESSURE REGULATOR SPRING
10. PRESSURE REGULATOR VALVE
11. RETAINER
12. FAIL-SAFE VALVE "A" SLEEVE
13. FAIL-SAFE VALVE A2
14. FAIL-SAFE VALVE "A" SPRING
15. FAIL-SAFE VALVE A1
16. TORQUE CONVERTER VALVE SPRING
17. TORQUE CONVERTER VALVE
18. BORE PLUG
19. RETAINER
20. FAIL-SAFE VALVE "B"
21. FAIL-SAFE VALVE "B" SLEEVE
22. RETAINER
23. SPACER PLATE

Figure 1

Techpak

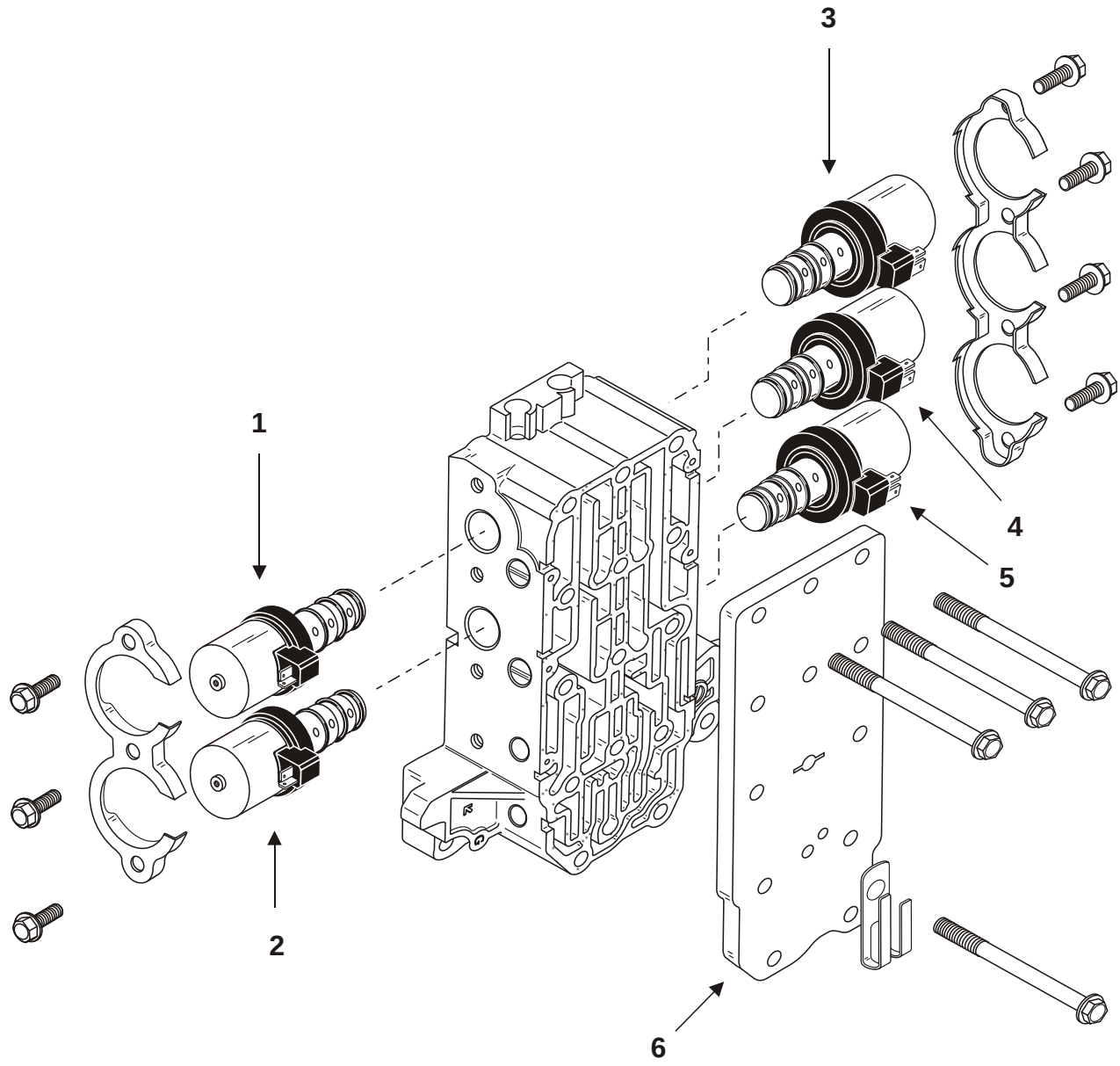
OUTER VALVE BODY



1. OUTER VALVE BODY ASSEMBLY
2. OVERDRIVE PRESSURE CONTROL VALVE SPRING
3. OVERDRIVE PRESSURE CONTROL VALVE
4. OVERDRIVE PRESSURE CONTROL VALVE SLEEVE
5. RETAINER
6. LOW - REVERSE PRESSURE CONTROL VALVE SPRING
7. LOW - REVERSE PRESSURE CONTROL VALVE
8. LOW - REVERSE PRESSURE CONTROL VALVE SLEEVE
9. RETAINER
10. SWITCHING VALVE
11. BORE PLUG
12. RETAINER
13. RETAINER
14. UNDERDRIVE PRESSURE CONTROL VALVE SLEEVE
15. UNDERDRIVE PRESSURE CONTROL VALVE
16. UNDERDRIVE PRESSURE CONTROL VALVE SPRING
17. RETAINER
18. SECOND PRESSURE CONTROL VALVE SLEEVE
19. SECOND PRESSURE CONTROL VALVE
20. SECOND PRESSURE CONTROL VALVE SPRING
21. SPACER PLATE
22. EXHAUST CHECK BALLS

Figure 2

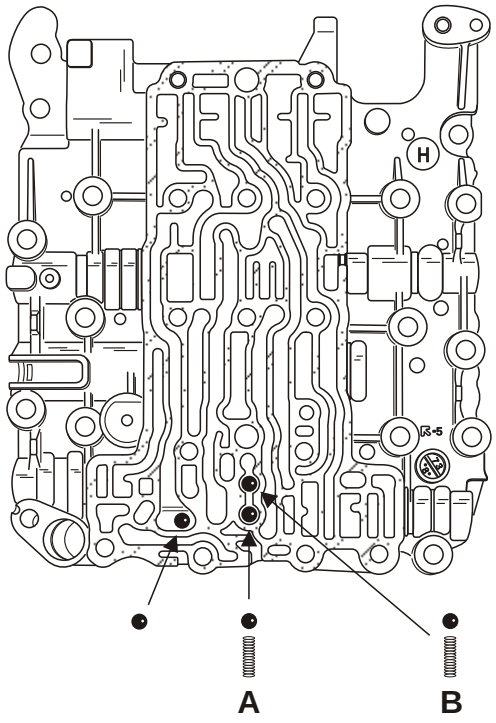
SOLENOID LOCATIONS

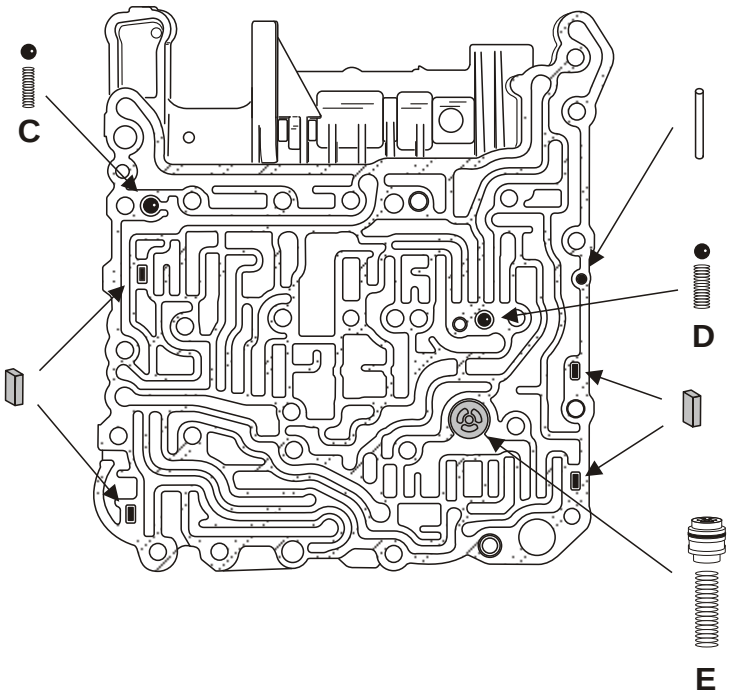


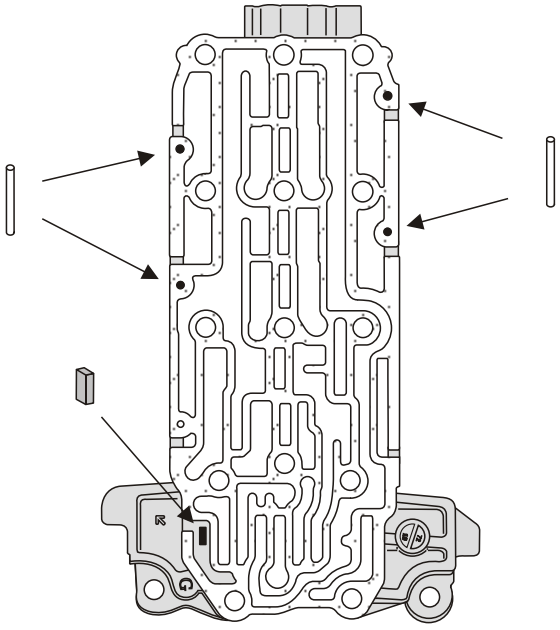
1. OVERDRIVE SOLENOID
2. LOW - REVERSE SOLENOID
3. UNDERDRIVE SOLENOID
4. SECOND SOLENOID
5. TORQUE CONVERTER CLUTCH CONTROL SOLENOID
6. COVER

Figure 3

CHECKBALL LOCATIONS







CHECKBALL AND SPRING DIMENSIONS		
SPRING	LENGTH	DIAMETER
A	.665	.177
B	.665	.177
C	.665	.177
D	.677	.277
E	1.398	.300
ALL CHECKBALLS ARE .250" DIAMETER		

Figure 4

A4AF3/A4BF2

NO FORWARD IN DRIVE AFTER OVERHAUL
MANUAL LOW & REVERSE OK

COMPLAINT: A no forward condition in the Drive range after rebuild, reverse and manual low ok. May engage in Drive during high engine RPMs, then neutral out and stop moving.

CAUSE: The PCSV-A pressure control solenoid with the black wire being switched with the location of the PCSV-B pressure control solenoid with blue wire during rebuild.

CORRECTION: Replace the solenoids to their correct locations. The diagram in Figure 1 will show the correct location of all six solenoids and wire color. Figure 2 will demonstrate the oil flow and the position of Pressure Control Valve B when the solenoids are in the right location. Allowing oil flow to the rear (forward) clutch drum. The partial oil schematic in Figure 3 will explain why there will be no movement in the Drive range when the solenoids are in the wrong location. Notice that when the PCSV-A solenoid is place in the location of the PCSV-B in the Drive range. The normal firing order of the solenoids will be incorrect in this location. The PCV-B position will cut off oil flow to the forward drum causing no forward movement in the Drive detent. There may or may not be any movement when engine rpm is increased. Manual low and reverse will be ok.

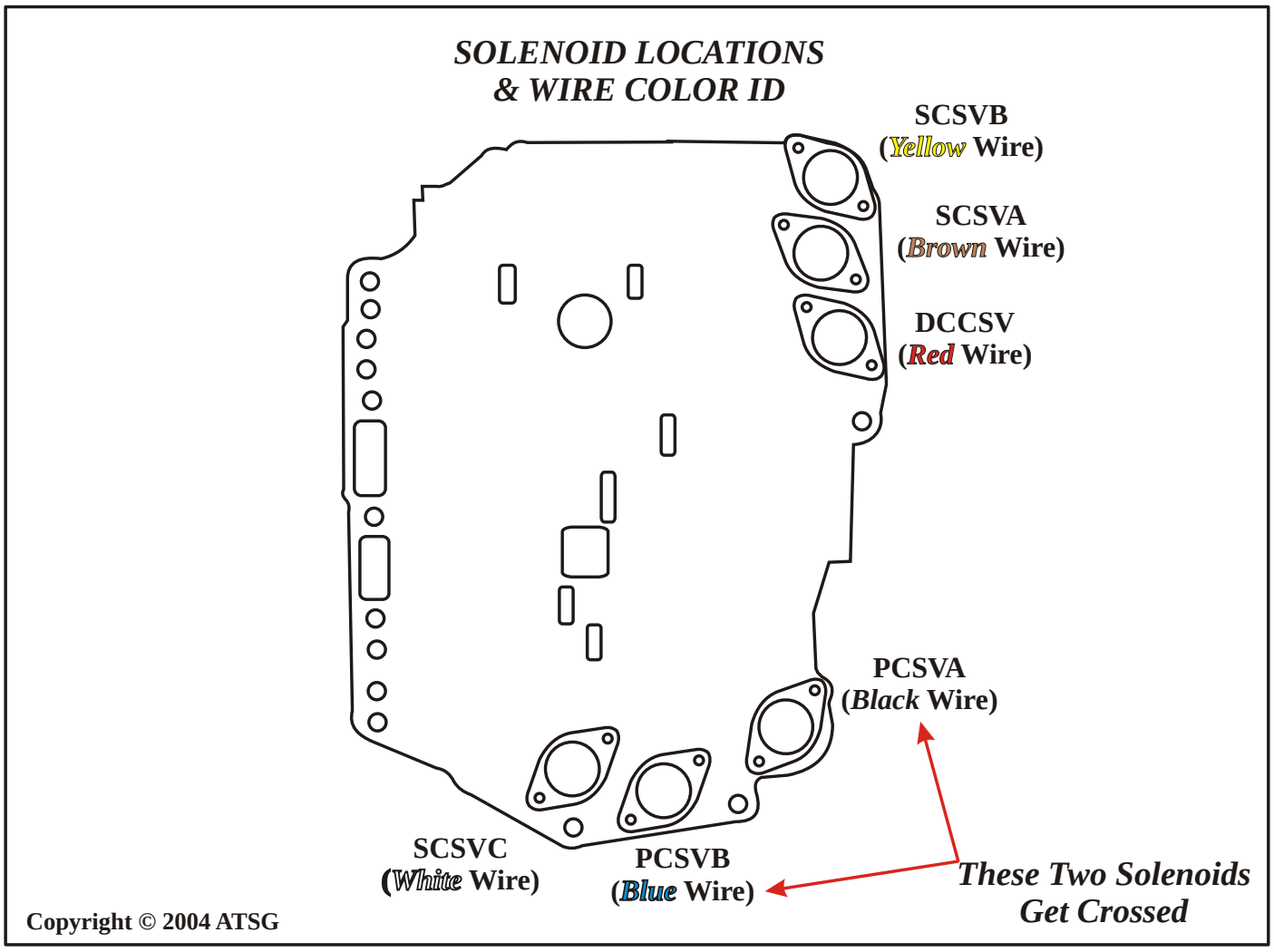


Figure 1

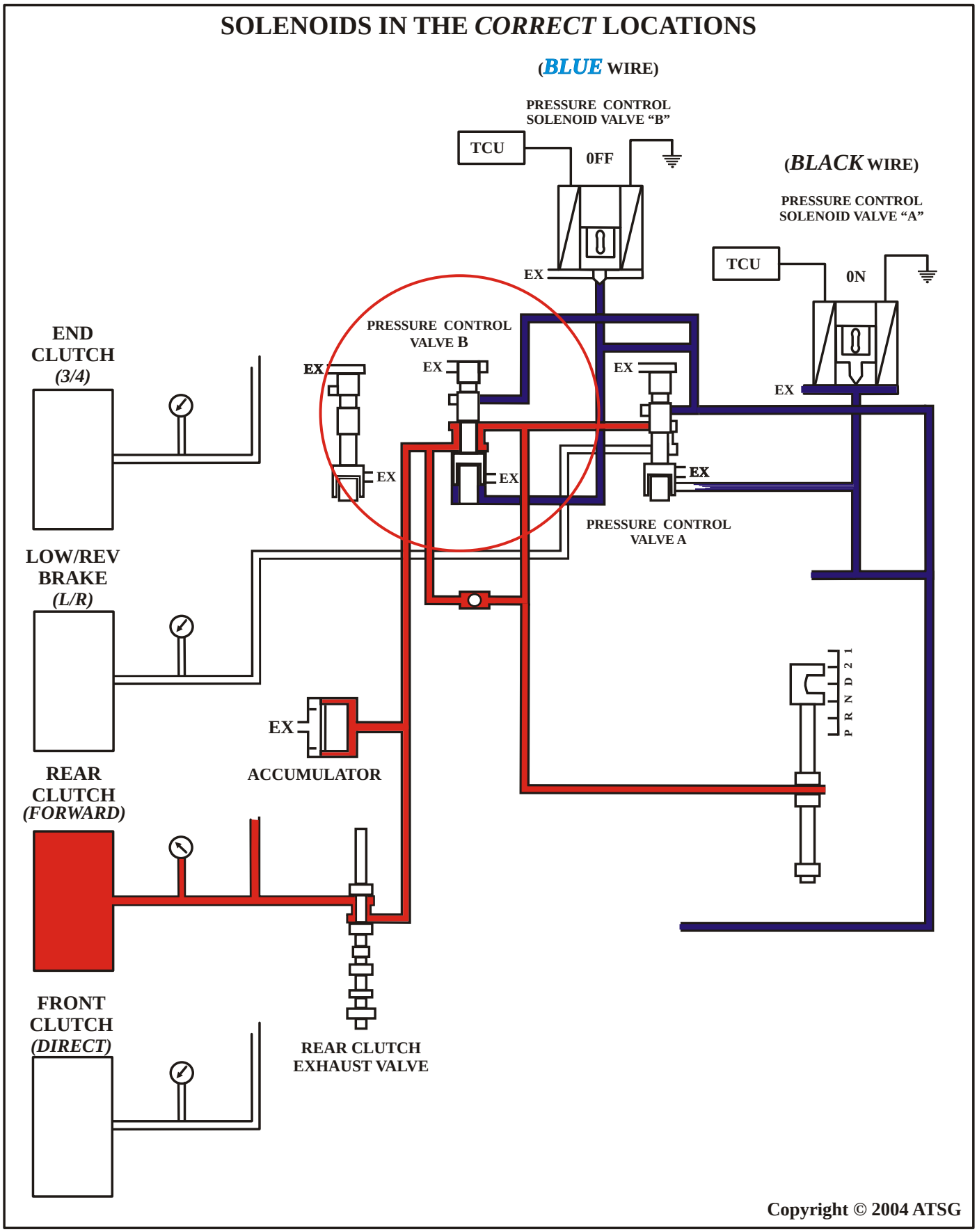

SOLENOIDS IN THE *CORRECT* LOCATIONS
(BLUE WIRE)
PRESSURE CONTROL SOLENOID VALVE "B"
TCU
0FF
(BLACK WIRE)
PRESSURE CONTROL SOLENOID VALVE "A"
TCU
0N
EX
PRESSURE CONTROL VALVE B
EX
EX
EX
EX
EX
EX
EX
PRESSURE CONTROL VALVE A
END CLUTCH (3/4)
LOW/REV BRAKE (L/R)
REAR CLUTCH (FORWARD)
FRONT CLUTCH (DIRECT)
EX
ACCUMULATOR
REAR CLUTCH EXHAUST VALVE
P R N D 2 1
Copyright © 2004 ATSG

Figure 2

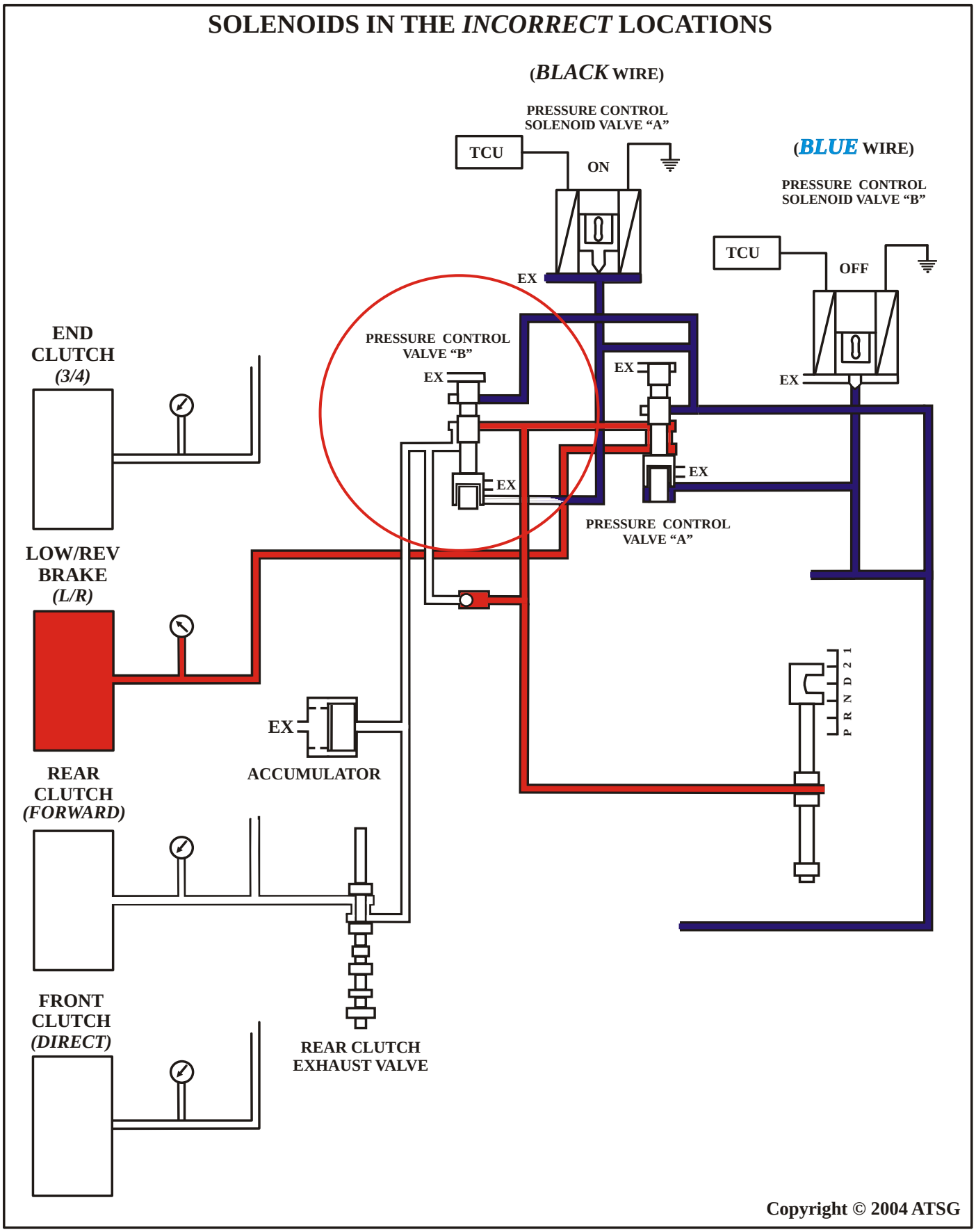

SOLENOIDS IN THE *INCORRECT* LOCATIONS
(*BLACK* WIRE)
PRESSURE CONTROL SOLENOID VALVE "A"
TCU
ON
(*BLUE* WIRE)
PRESSURE CONTROL SOLENOID VALVE "B"
TCU
OFF
EX
PRESSURE CONTROL VALVE "B"
EX
EX
EX
EX
EX
PRESSURE CONTROL VALVE "A"
END CLUTCH (3/4)
LOW/REV BRAKE (L/R)
REAR CLUTCH (FORWARD)
FRONT CLUTCH (DIRECT)
EX
ACCUMULATOR
REAR CLUTCH EXHAUST VALVE
P R N D 2 1
Copyright © 2004 ATSG

Figure 3

3L30 (180C TRIMATIC)

NO TCC APPLICATION

COMPLAINT: Diagnosing a "No TCC" condition on a 1989 to 1998 GEO Tracker or Suzuki Sidekick with a 1.6L engine and the 3L30 (180C) due to the complexity of the TCC control system.

CAUSE: Any one or more of the TCC control system components such as the TCC Solenoid, the Governor Pressure Switch, the Transmission Relay, the ECM, a missing Feed Pipe O-Ring or a Converter Clutch Control Valve problem, etc., can be the cause of the above complaint.

CORRECTION: The internal adaptation and description of the components used to control converter clutch apply can be seen in Figures 1 and 2. The bottom pipe coming from the valve body is band release pressure otherwise known as third gear oil. This ensures that the vehicle will never have TCC until 3rd gear. When the solenoid is energized this oil is routed through the upper pipe to the pump cover (Figure 3 and 4) where it strokes the converter clutch control valve into the lock up position.

In addition to the solenoid receiving 3rd gear oil, a governor pressure switch is utilized to time control (*via speed*) a voltage supply to the solenoid. In the example shown in Figures 1 and 2, it can be noticed that the pressure switch is rated to close at 43.5 psi. Also notice that the solenoid is permanently grounded. Putting this together with considering a properly operating system, 3rd gear is typically reached by approximately 35 miles per hour. This means the solenoid will have received 3rd gear oil before governor pressure is high enough to close the switch (*The idea is to prevent a converter clutch apply on top of the 2-3 shift*). Once governor pressure increases enough to close the switch (*40 mph or above*), voltage is supplied to the "already grounded" solenoid. Once energized, third gear oil is allowed to pass through the solenoid and stroke the converter clutch control valve in the pump (See the partial hydraulics in Figures 5 and 6).

Figures 7 through 10 are typical wiring diagrams which reveal the external electronics controlling the voltage supply to the transmission. Using a 1995 Suzuki Sidekick as an example, the Main Relay can be located under the dash, while the Transmission Relay is located in the right side of the engine compartment forward of the battery as seen in Figure 11. These relay locations are very similar with the GEO Tracker as well as the ECM being located under the dash, high left of the steering column.

The wiring diagrams in Figures 7 through 10 indicate that the voltage supply to the Transmission Relay coil comes from the Main Relay. The ECM will ground the Transmission Relay after the vehicle is at operating temperature and the vehicle is moving. With the Transmission Relay coil energized, power from the Stop Lamp Switch is supplied to the transmission through a White Wire where it waits for the governor pressure switch to close at which time the solenoid becomes energized. It is noted in the wiring schematics that the Blue Wire is not used with 1991 and later vehicles.

3L30 (180C TRIMATIC)

NO TCC APPLICATION

CORRECTION *continued:* 1989 and 1990 vehicles had this wire returning to the ECM as "governor pressure switch feed back" informing the ECM of the Governor Switch state, whether it closed or not. A code 42 could be produced with these vehicles if voltage on the Blue Wire to the ECM remains hot at all times indicating a short to power. For 1991 and later, the wire remains in the harness but does not connect to the ECM.

Mechanically there could be a defective solenoid, a malfunctioning governor pressure switch, the o-ring left off the pump end of the feed pipe, the bore plug which retains the convert clutch control valve is not sealing, the valve is stuck or the converter has failed.

Electronically a bad splice could occur in the voltage feed circuit from the Main Relay to the Transmission Relay, a defective Transmission Relay, wiring problems from the relay to the ECM or from the relay to the transmission, internal transmission wiring problems, a defective ECT sensor, Stop Lamp Switch, VSS, TPS, CMP or ECM.

The first step in diagnosing a no TCC is to check for any DTC's which may point you in an electrical direction. Another step would be to drive the vehicle at 45 miles per hour checking for voltage to appear on the white wire. The meter could be easily attached to the white wire from under the hood as there is a joint connector that can be located under the throttle body. While driving the vehicle voltage should become present. If voltage is never seen, an external electrical problem exists (Transmission Relay, Stop Lamp Switch, wiring, ECM, ECT, VSS, TPS or CMP). If voltage is observed, all the external electrical components are working. Plug the connector back in to the transmission and repeat the test checking the blue wire for voltage. If voltage is seen, there is an internal mechanical problem with the converter, the oil pipes or the solenoid (See Figures 12 and 13 for solenoid bench test procedures). If voltage is not seen on the blue wire, the governor pressure switch is defective.

In 1995, a bulletin was issued concerning a TCC Chuggle/Hunting condition that was caused by the governor pressure switch opening and closing during vehicle speeds between 40-45 mph. To correct this condition, a Time Delay Module kit was produced to be installed by the Transmission Relay under the hood. This module delayed the voltage supply to the transmission as an attempt to ensure that with increased vehicle speed, the governor pressure would also increase past the threshold of the governor pressure switch eliminating the open/close toggle. The part number for this Time Delay Module kit is ***96041311.*** The Time Delay Module has a red wire coming out of one terminal with an open terminal along side of it. The white wire coming out of the transmission relay is removed and connected to the open terminal on the Time Delay Module. The red wire is then placed into the Transmission Relay where the white wire was previously located. This places the module in series between the relay and the transmission. The module is then clipped onto the nearby A/C fan relay. Vehicles with A/C, the kit also includes a rubber holding fixture designed to slide onto a tab on the fuse box which the Time Delay Module can then be attached to.

Starting with late production 1995 Tracker and Sidekicks, the governor pressure switch was eliminated altogether giving TCC control entirely over to the PCM.

NO TCC APPLICATION

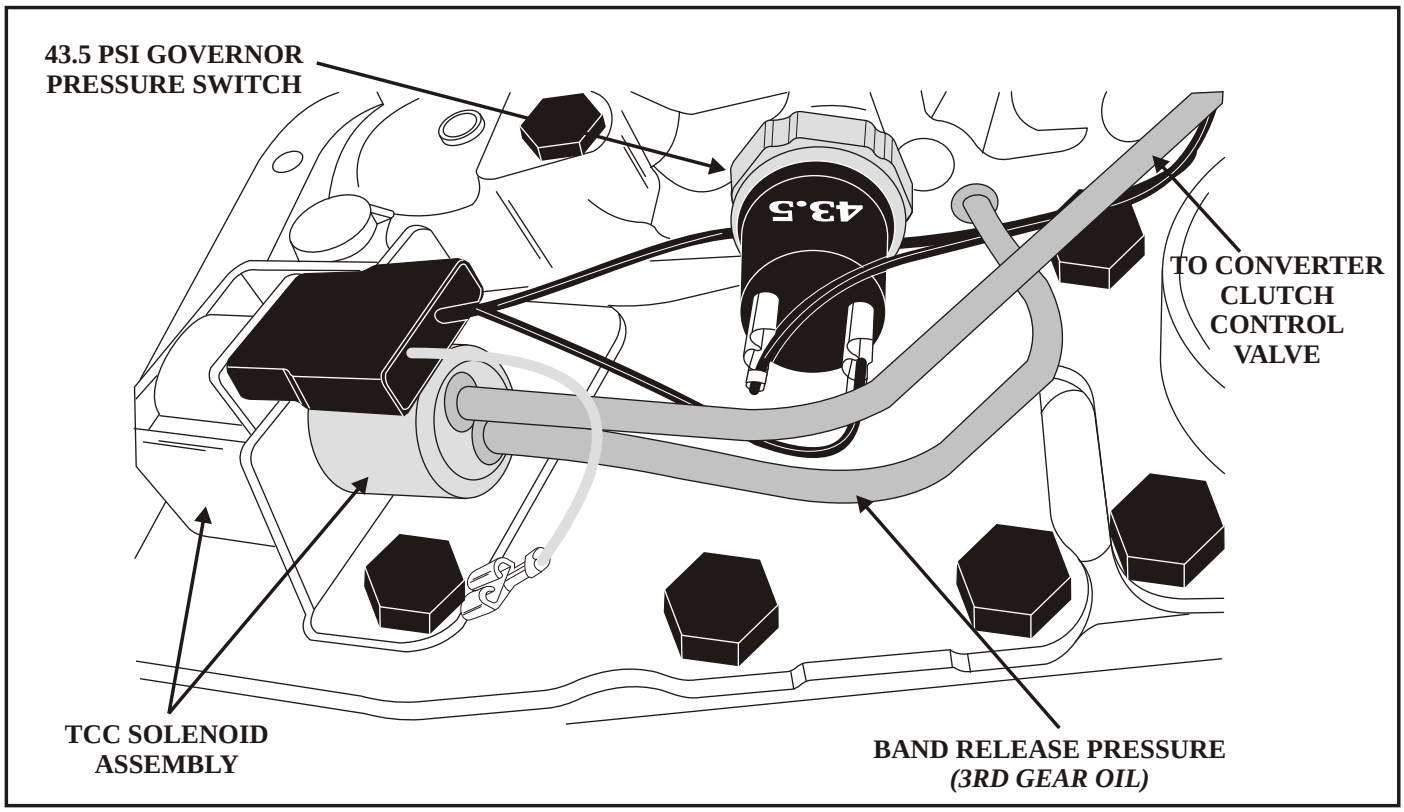


Figure 1

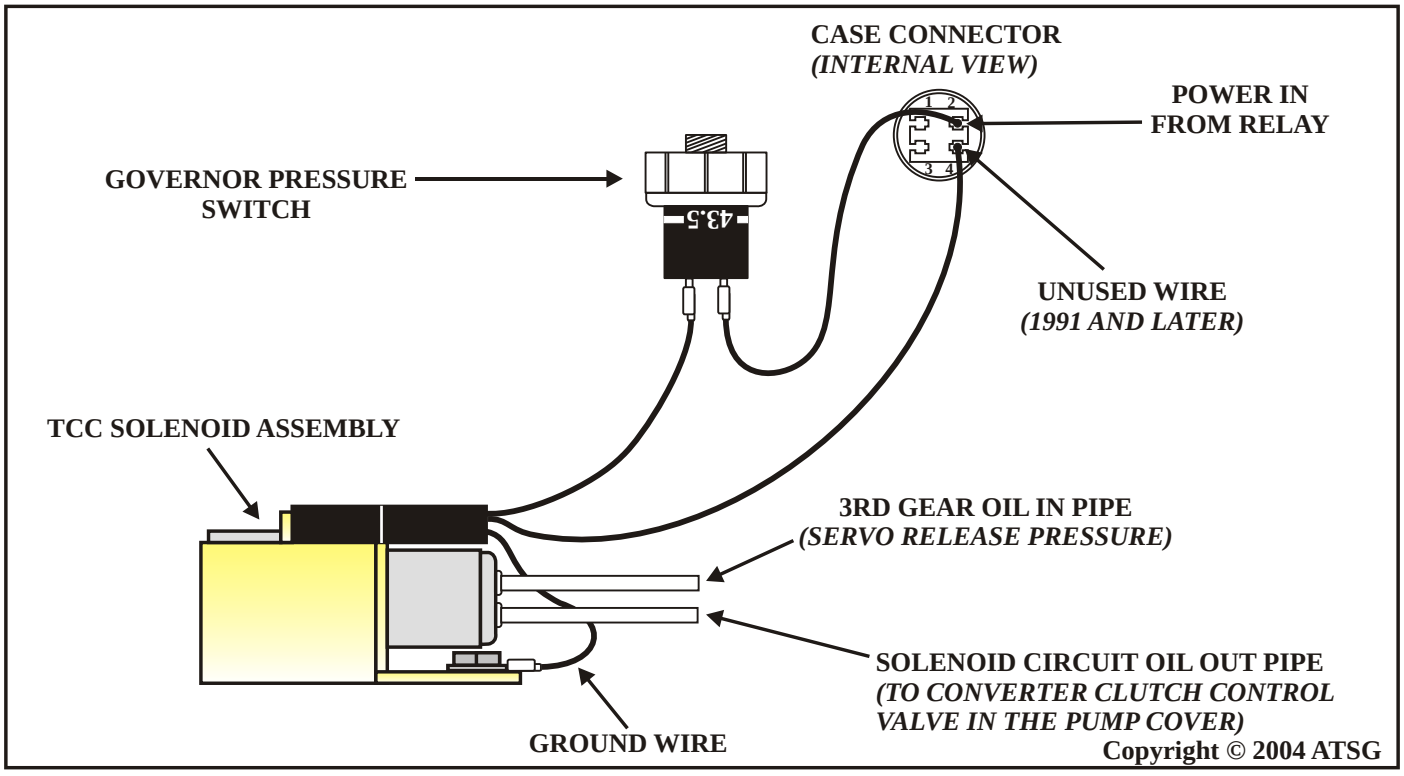


Figure 2

NO TCC APPLICATION

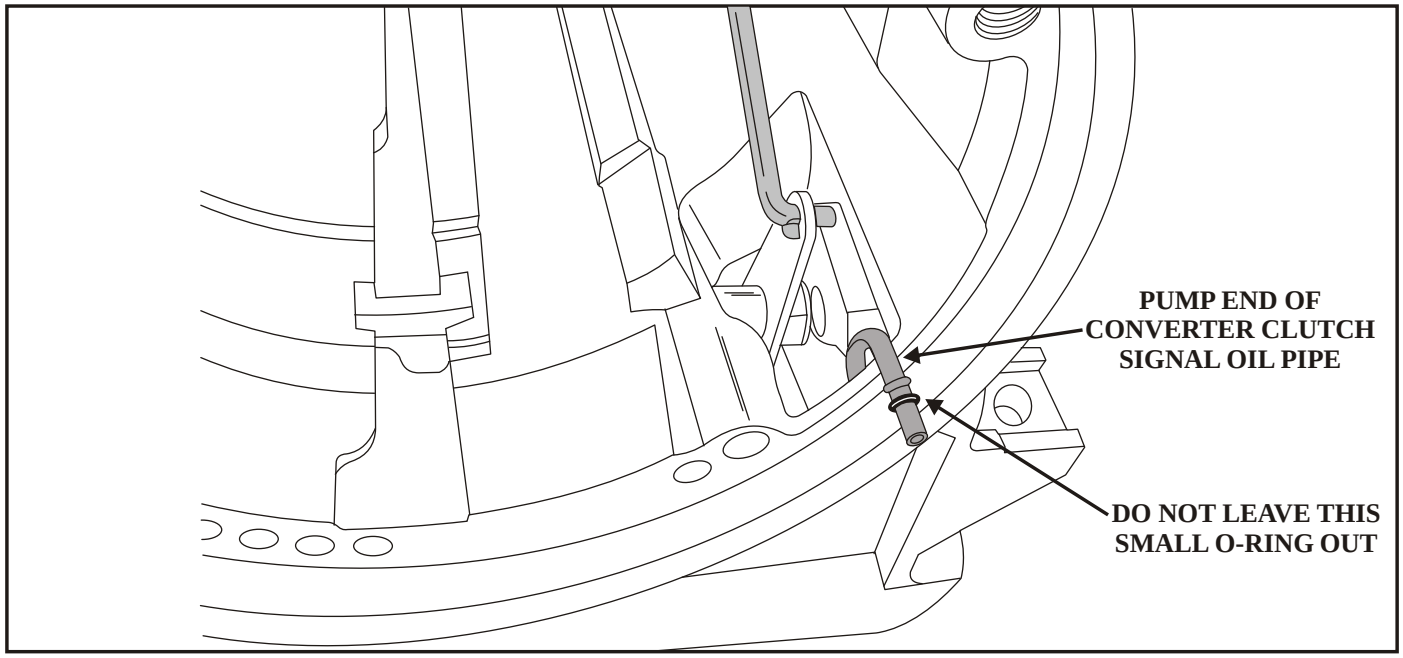


Figure 3

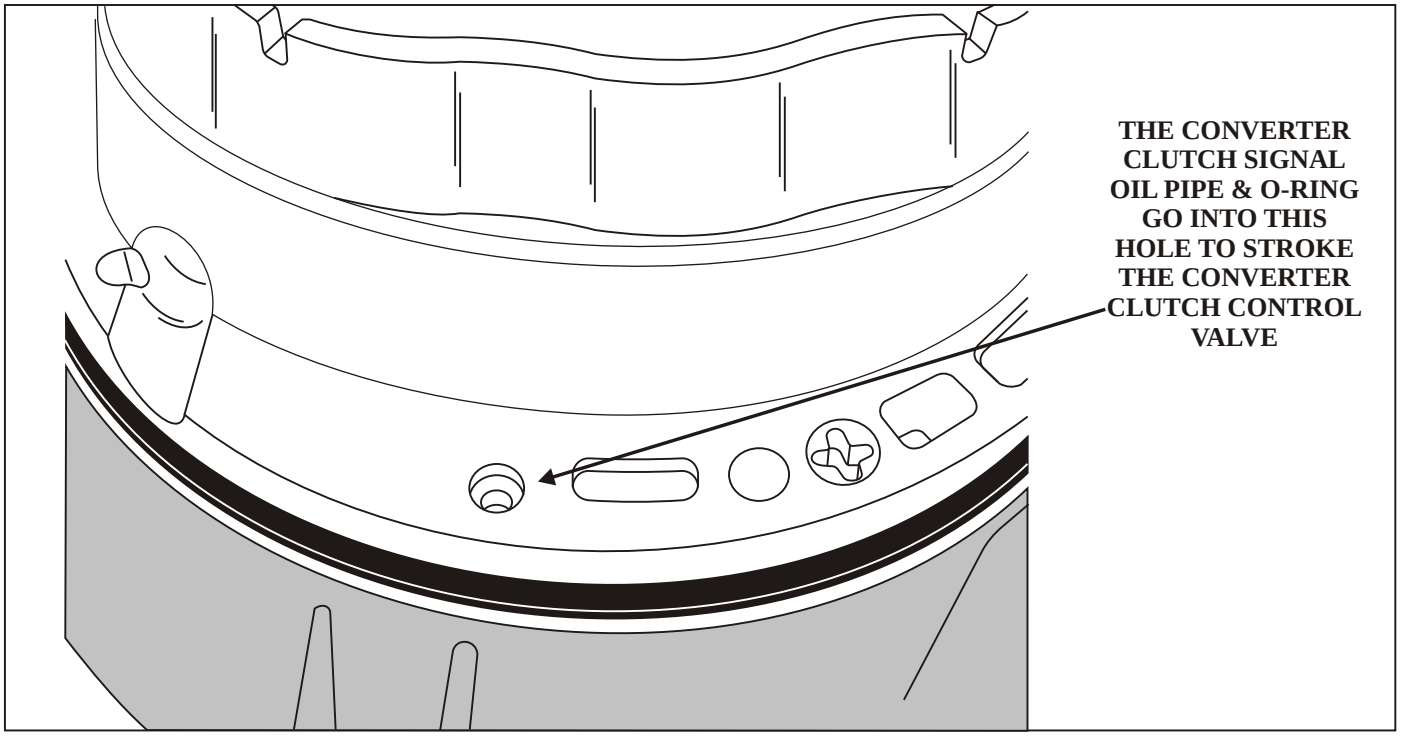


Figure 4

NO TCC APPLICATION

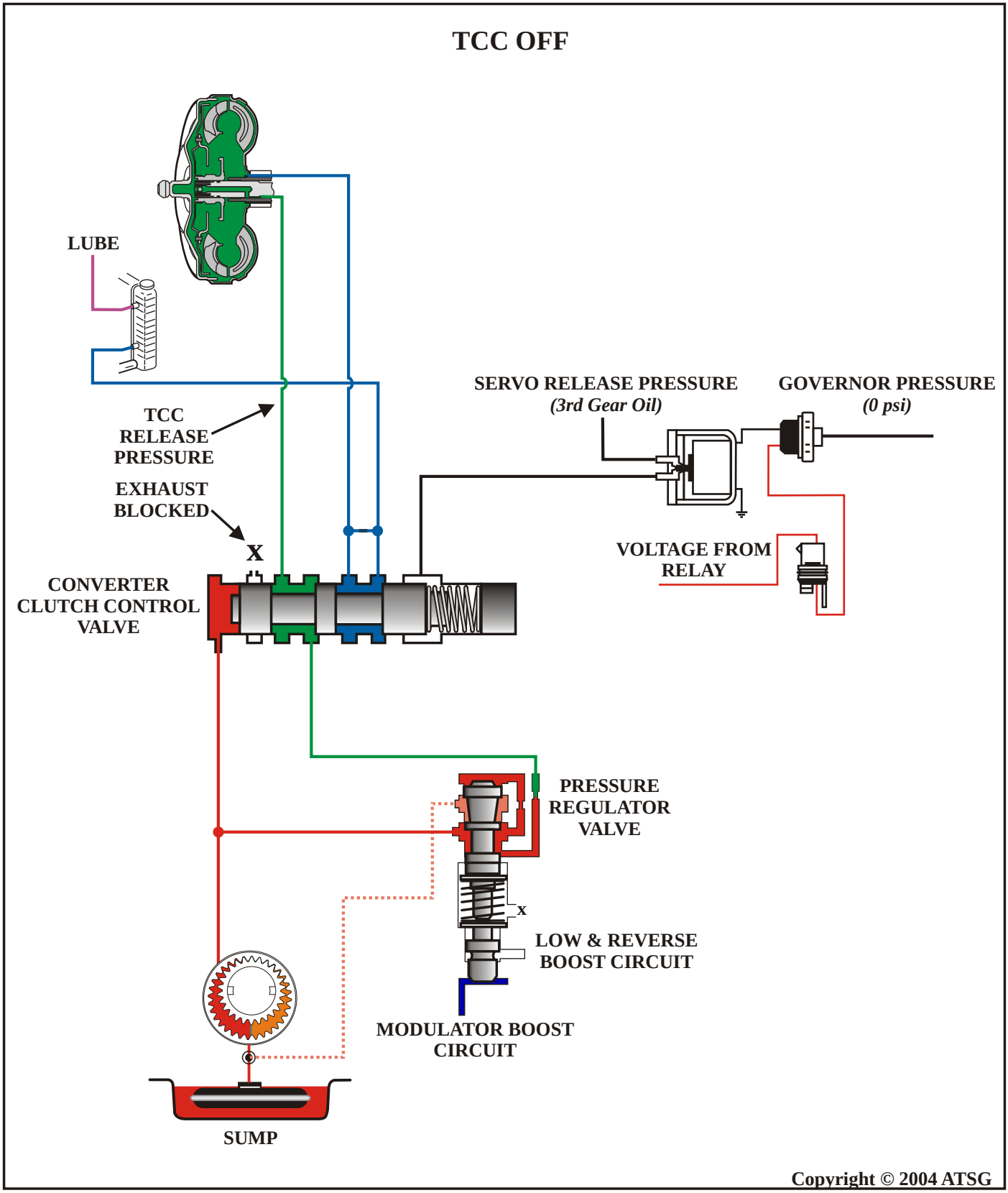


Figure 5

NO TCC APPLICATION

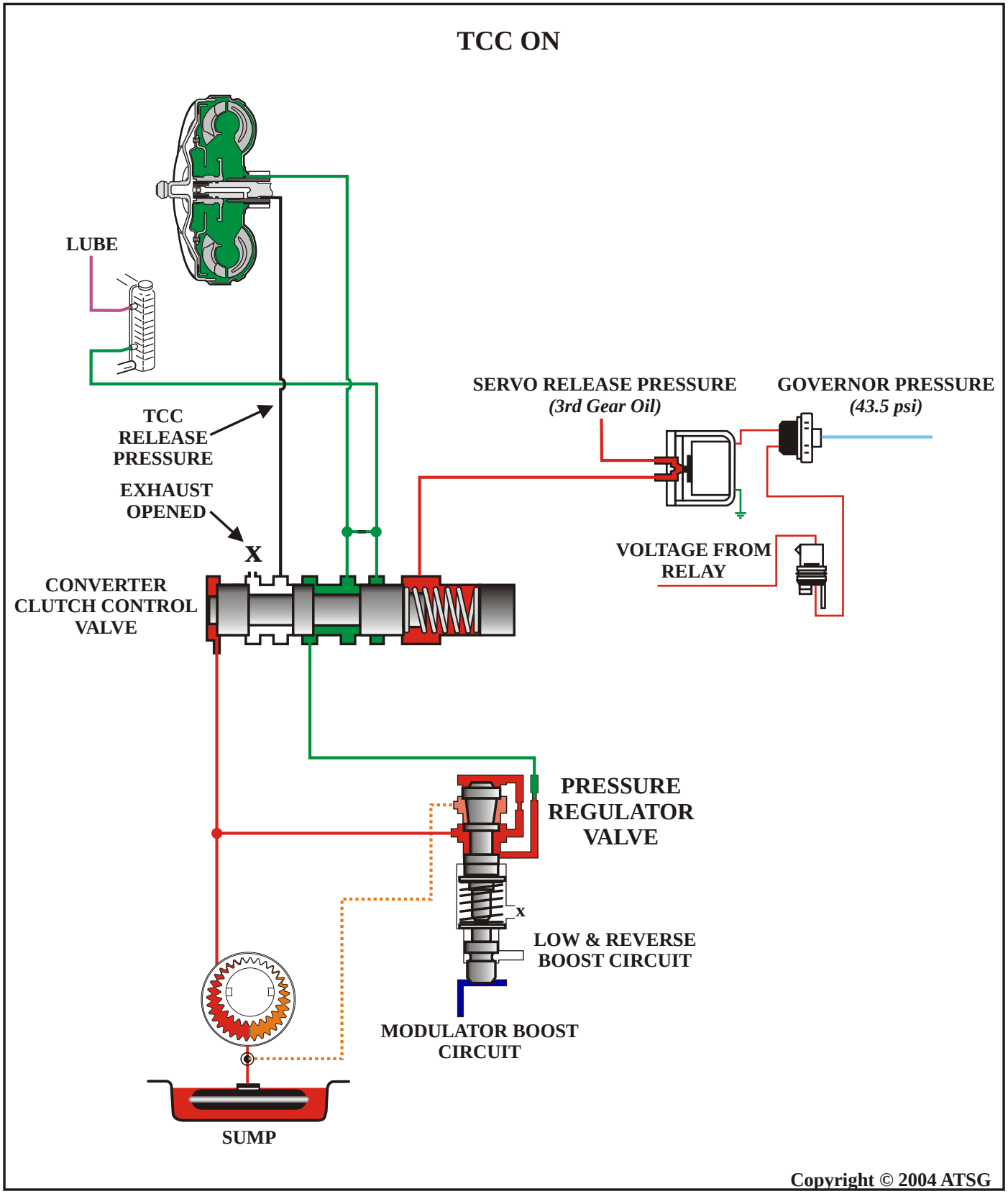


Figure 6

NO TCC APPLICATION

IGNITION OFF

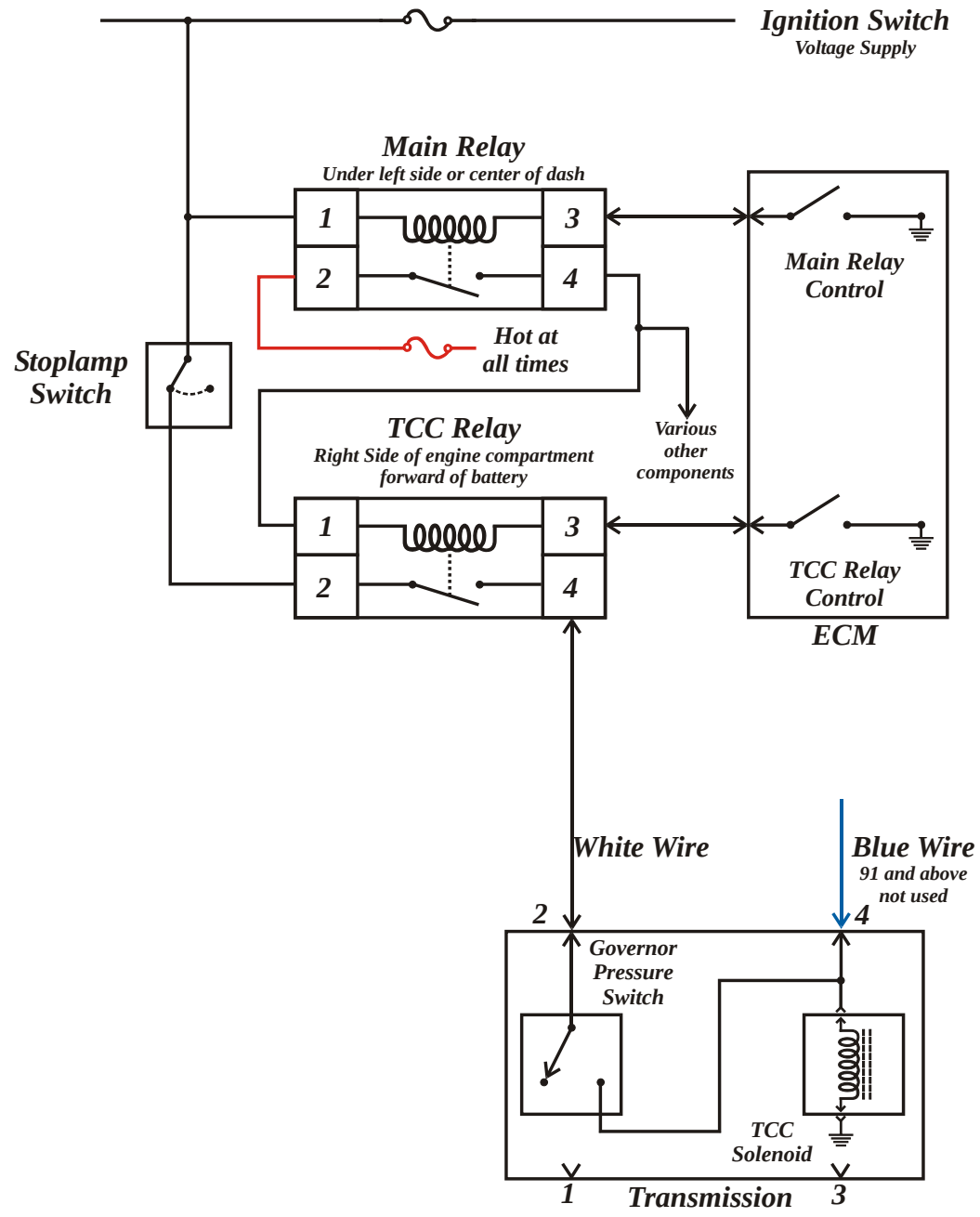


Figure 7

NO TCC APPLICATION

IGNITION ON AT IDLE

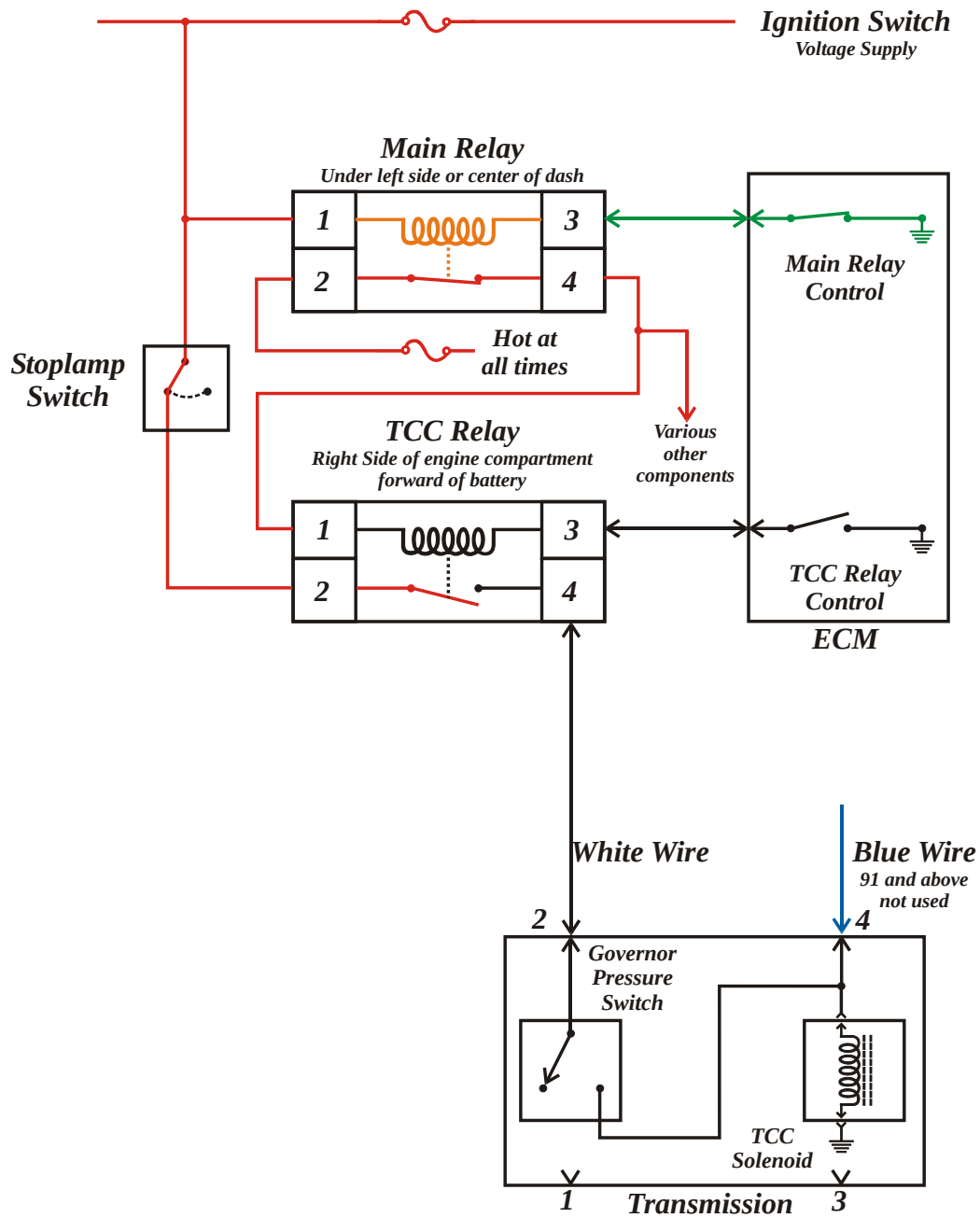


Figure 8

NO TCC APPLICATION

VEHICLE AT OPERATING TEMPERATURE AT APPROXIMATELY 40 MPH OR MORE.

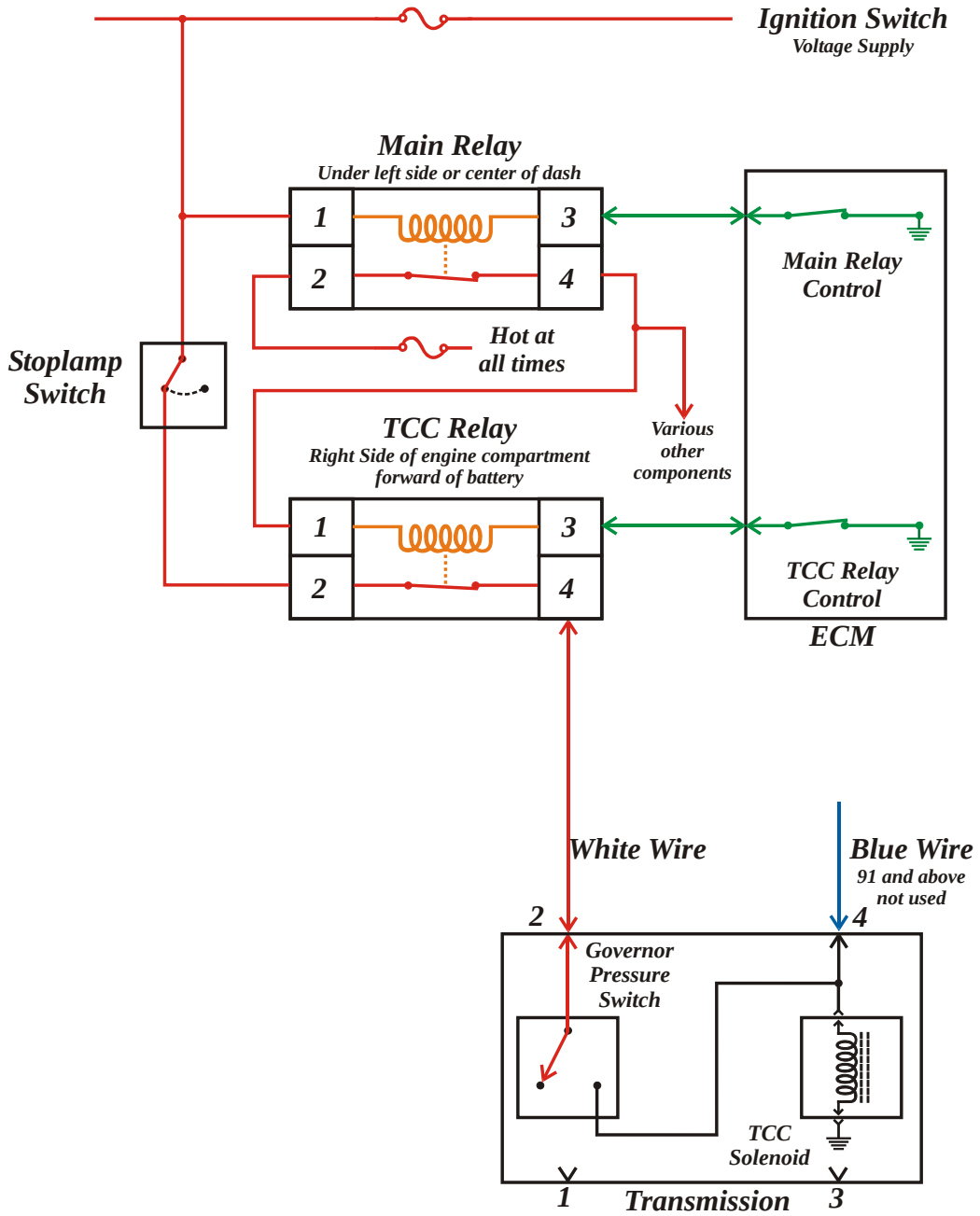


Figure 9

NO TCC APPLICATION

**VEHICLE AT PROPER OPERATING REQUIREMENTS
AND THE GOVERNOR PRESSURE HAS CLOSED THE SWITCH.**

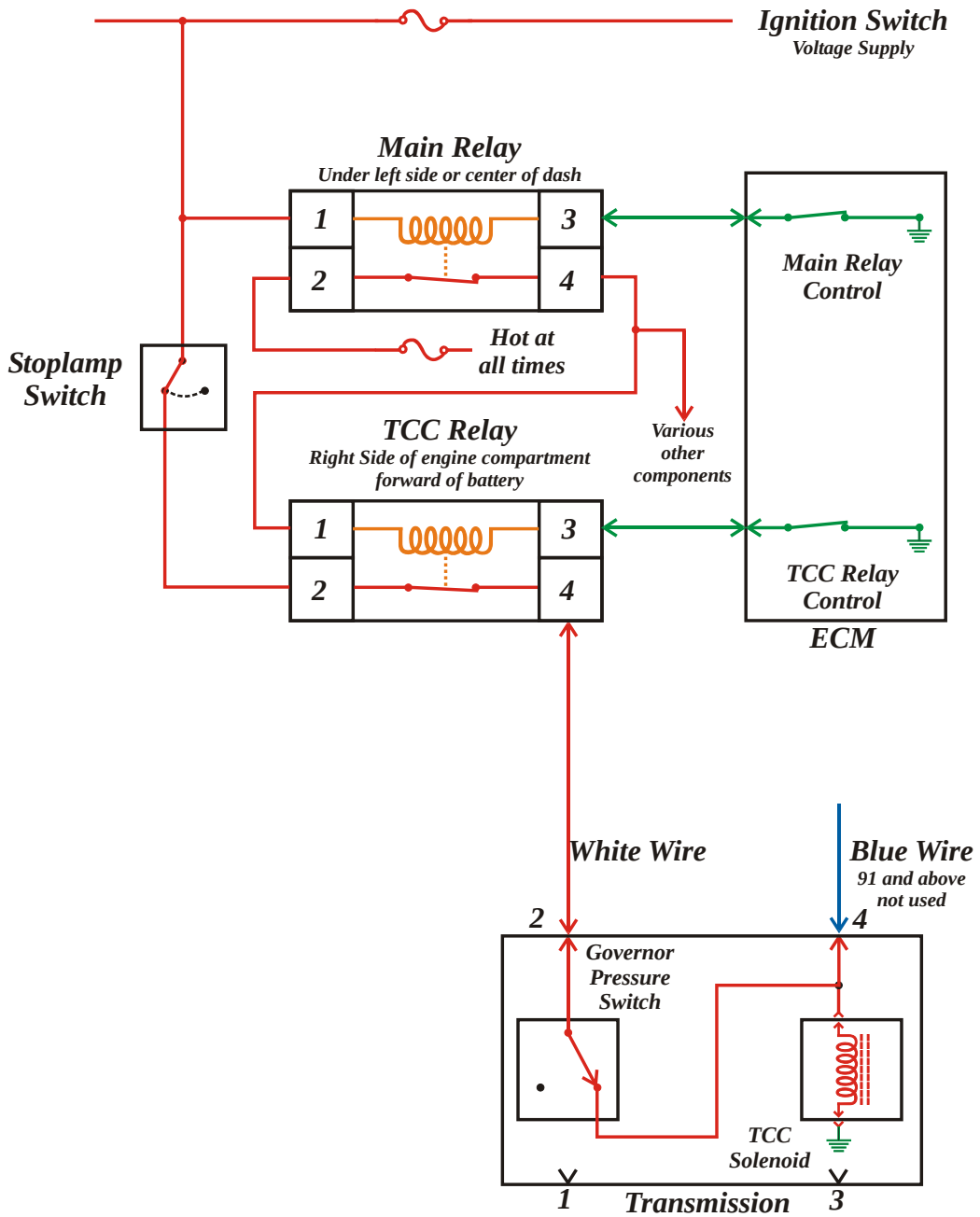
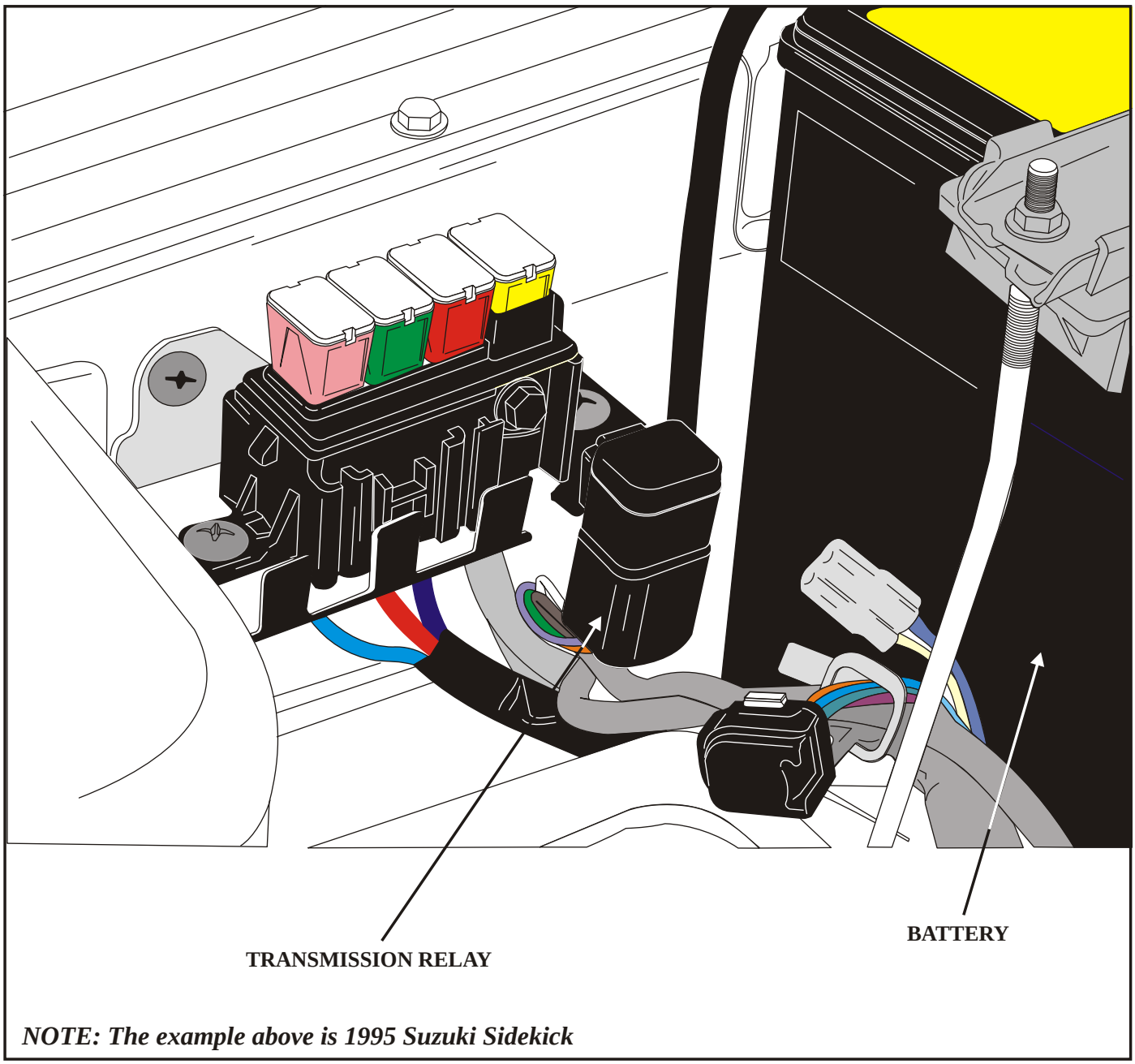


Figure 10

NO TCC APPLICATION



NOTE: The example above is 1995 Suzuki Sidekick

Figure 11

TCC SOLENOID TEST

WITH THE SOLENOID ENERGIZED, SQUEEZE FLUID INTO THE SOLENOID FLUID CHAMBER FROM AN OIL BOTTLE THROUGH THE UPPER PIPE HOLE WHILE THE LOWER PIPE HOLE IS BLOCKED

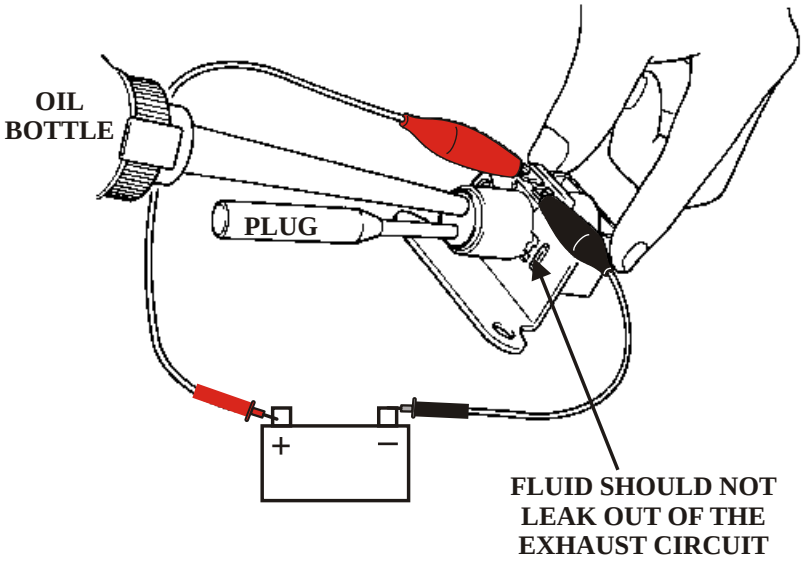


Figure 12

WITH THE SOLENOID DE-ENERGIZED, SQUEEZE FLUID INTO THE SOLENOID FLUID CHAMBER FROM AN OIL BOTTLE THROUGH THE UPPER PIPE HOLE WHILE THE LOWER PIPE HOLE IS BLOCKED

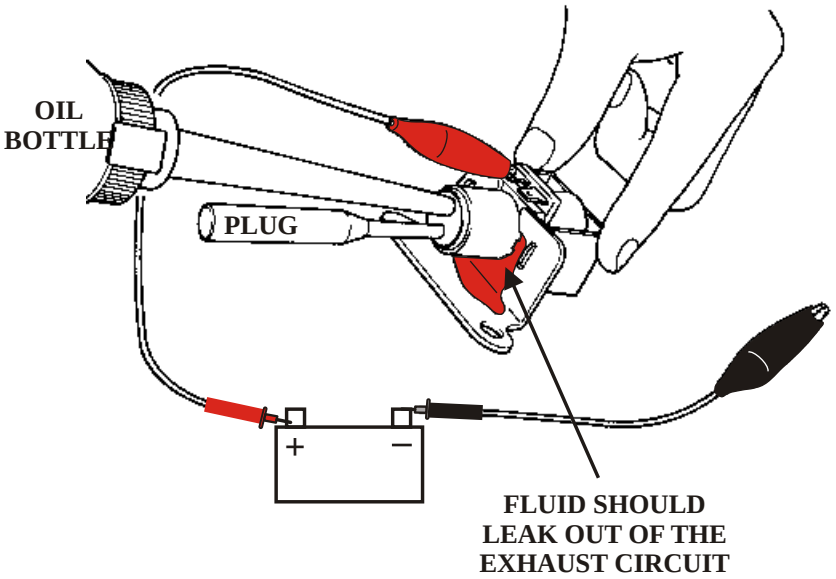


Figure 13

TOYOTA/LEXUS

SHIFT COMPLAINTS AFTER OVERHAUL

COMPLAINT: The vehicle exhibits shift feel and driveability complaints after the transmission has been overhauled or replaced.

CAUSE #1: Vehicles equipped with fully electronic controlled transmissions require an ECM Memory Reset to restore the ECM "Relearned Values".

CAUSE #2: Use of incorrect transmission fluid. Certain transmissions require Toyota T-IV or WS automatic transmission fluid while others can use Dexron® III.

CORRECTION #1: The ECM Reset procedure for the following vehicles is performed with a capable scan tool only:

2000 - 2003 Echo and Celica
2001 - 2003 Highlander and RAV4
2002 - 2003 Camry
2002 - 2003 Solara with 2AZ engine
2003 - Matrix
2004 - Sienna

The ECM Reset procedure for the following vehicles can be performed with a capable scan tool or a manual method:

2000 - Highlander and RAV4
2000 - 2001 Solara with 5S engine
2000 - 2003 4Runner, Avalon, Corolla, Land Cruiser and Sienna
2000 - 2003 Tacoma and Tacoma Pre-Runner
2000 - 2003 Tundra
2001 - 2003 Sequoia

The manual ECM Reset procedure is as follows:

1. ***Record radio station presets and #1 driver's seat memory position.***
2. ***Disconnect the negative battery cable for 5 minutes.***
3. ***Reconnect battery cable and reset radio presets and #1 driver's seat memory position.***
4. ***Start the engine and warm it up to normal operating temperature.***
5. ***Perform a thorough test drive with several accelerations from a stop with light throttle application until proper transmission shifting is verified.***

NOTE: The following operations may need to be performed:

1. ***Initialize moon roof.***
2. ***Initialize power windows***
3. ***Calibrate compass.***

TOYOTA/LEXUS

SHIFT COMPLAINTS AFTER OVERHAUL

CORRECTION #1 ***continued:***

Procedure for Initialization of Moon Roof:

1. Push and hold down the "TILT UP" side of the switch until moon roof tilts all the way up and then tilts down slightly, (approximately 10 mm at the rear).
2. Check for proper operation of the "One-touch slide open/close" and "One-touch tilt up/down" functions by pushing the switch briefly to the "SLIDE OPEN" and TILT UP" position.

Procedure for Initialization of Power Windows

1. Turn the ignition switch ON.
2. Open the driver's window halfway by pressing the driver's power window switch.
3. Pull the switch all the way up until the window is fully closed and continue to hold the switch for 3 seconds.
4. Release the switch and check that the "AUTO UP/DOWN" function operates normally.

Procedure for Rear Window Initialization (SUVs)

1. Turn the ignition switch ON.
2. Open the back door glass fully.
3. Press the back door power window switch until it is fully closed and continue to hold the switch for 1 second or more.
4. Check that the "AUTO UP/DOWN" function operates normally.

Procedure for Compass Calibration

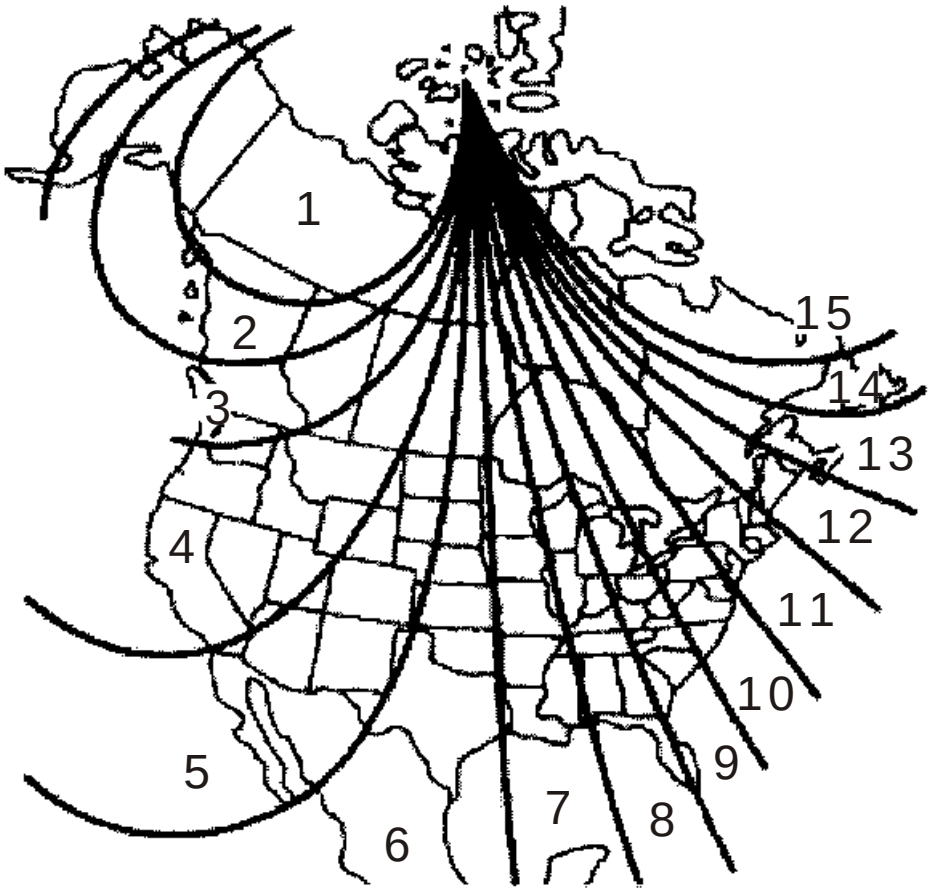
1. Turn the ignition switch ON and check that the Direction N, NE ,E, SE, S, SW, W, NW appears on the compass display located in the rear view mirror, (Pushing the "COMP SWITCH" turns the compass display ON and OFF).
2. Push the "MODE SWITCH" for longer than 3 seconds until the zone number (1 - 15) appears on the display. Then push the switch to select the number of the zone where the vehicle is located, (See Figure 1).
3. Check that the direction N, NE, E, SE, S, SW, W, NW or C appears several seconds after adjustment.
4. Start the engine and push the switch for 6 seconds until "C" appears on the display.
5. Drive the vehicle at 5 mph, or less, in a circle until the direction is displayed. If there is not enough space to drive in a circle, drive around the block until the direction is displayed.

IMPORTANT NOTES:

1. Do NOT perform calibration of the compass in a place where the earth's magnetic field is subject to interference by artificial magnetic fields such as underground parking, under steel structures, between buildings, etc.
2. During calibration, do not operate electrical systems such as moon roof, power windows, etc, as they may interfere with the calibration.

SHIFT COMPLAINTS AFTER OVERHAUL

CORRECTION #1 Use the illustration below for the correct map reference number for compass ***continued:*** calibration.



Zone numbers for areas NOT indicated on the map are as follows:
1. Hawaii - 5
2. Puerto Rico - 10
3. American Samoa - 6
4. Guam - 8
5. Saipan - 8

Figure 1

CORRECTION #2: Some Toyota transmissions require a special type of automatic transmission fluid. It has been ATSG's experience that the use of other fluids have caused shift feel complaints in the transmissions even after the ECM reset has been completed. Use the chart in figure 2 for Toyota vehicles, and the chart in figure 3 for Lexus vehicles to determine which fluid should be used in which transmission.

Rockland

TOYOTA TRANSMISSION FLUID USAGE CHART

MODEL	2000	2001	2002	2003	2004
Avalon	A541E	A541E	A541E	A541E	A541E
Camry	A140E / A541E	A140E / A541E	U140E / U241E	U140E / U241E	U140E / U241E
Celica	U240E / U341E	U240E / U341E	U240E / U341E	U240E / U341E	U240E / U341E
Corolla	A131 / A245E	A131 / A245E	A131 / A245E	A245E	A245E
ECHO	U340E	U340E	U340E	U340E	U340E
Highlander	N/A	U140E/U140F/U241E	U140E/U140F/U241E	U140E/U140F/U241E	U140E/U140F/U241E
Land Cruiser	A343F	A343F	A343F	A343F	A750F
RAV4	A247E / A540H	U140F / U241E	U140F / U241E	U140F / U241E	U140F / U241E
Sequoia	N/A	A340E / A340F	A340E / A340F	A340E / A340F	A340E / A340F
Sienna	A540E	A541E	A541E	A541E	A541E
Solara	A140E / A541E	A140E / A541E	A140E / U241E	U241E	U241E
Tacoma	A340E/A340F/A43D	A340E/A340F/A44D	A340E/A340F/A44D	A340E / A340F	A340E / A340F
Tundra	A340E / A340F	A340E / A340F	A340E / A340F	A340E / A340F	A340E / A340F
4Runner	A340E / A340F	A340E / A340F	A340E / A340F	A340E / A340F	A750E / A750F
Matrix	N/A	N/A	N/A	A246E/U240E/U341F	A246E/U240E/U341F
Prius	N/A	P111	P111	P111	P111

FLUID TYPE	PART NUMBER
Dexron® III	00718-ATF00
T-IV	08886-81015
WS	08886-02305

Figure 2

LEXUS TRANSMISSION FLUID USAGE CHART

MODEL	2000	2001	2002	2003	2004
GS300	A650E	A650E		A650E	A650E
GS400		N/A	N/A	N/A	N/A
ES300	U140E	U140E	U150E	U150E	N/A
ES330	N/A	N/A	N/A	N/A	A150E
RX300	U140E / U140F	U140E / U140F	U140E / U140F	U140E / U140F	N/A
RX330	N/A	N/A	N/A	N/A	U150E
LS400	A650E	N/A	N/A	N/A	N/A
SC300	A340E	N/A	N/A	N/A	N/A
SC400	A650E	N/A	N/A	N/A	N/A
SC430	N/A	N/A	A650E	A650E	A650E
LS430	N/A	A650E	A650E	A650E	A761E
GS430	N/A	A650E	A650E	A650E	A650E
IS300	N/A	A650E	A650E	A650E	A650E
LX470	A343F	A343F	A343F	A343F	A750E / A750F
GX470	N/A	N/A	N/A	A750E / A750F	A750E / A750F

FLUID TYPE	PART NUMBER
Dexron® III	00718-ATF00
T-IV	08886-81015
WS	08886-02305

Figure 3

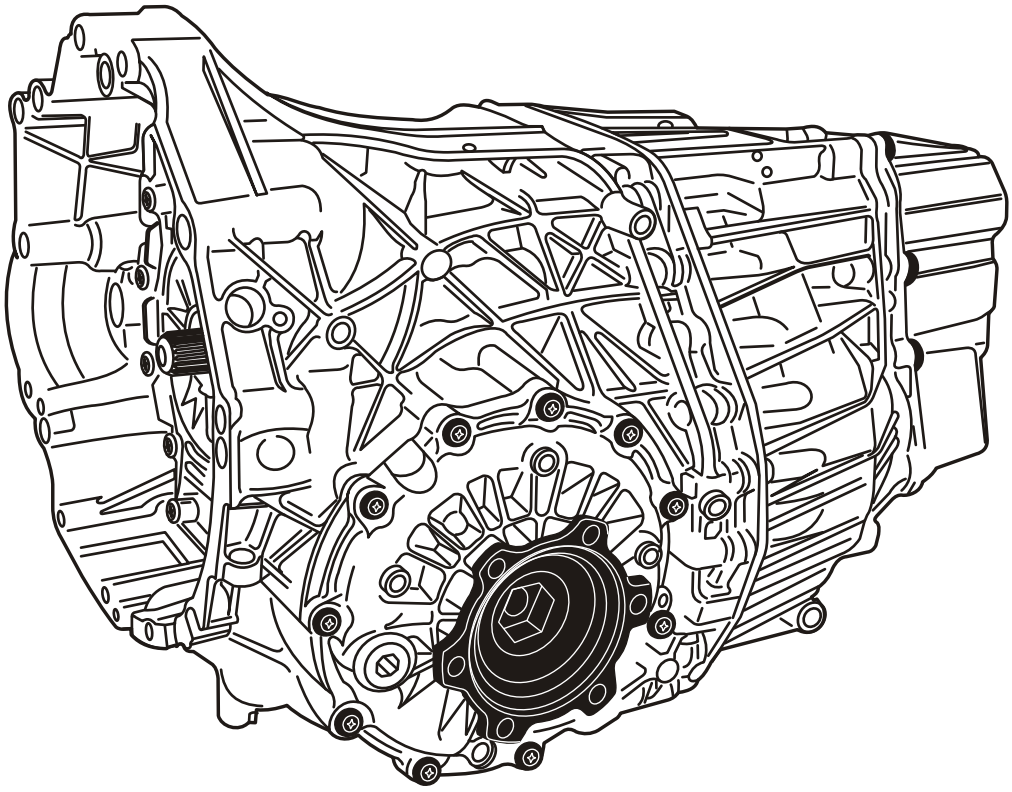
European

European

AUDI MULTITRONIC 01J CVT

PRELIMINARY INFORMATION

THE 01J MULTITRONIC®
2004 Audi A4 and A6
1.8L and 3.0L



The 2002 and later Audi A6 and the 2003 and later A4 with 1.8L or 3.0L engines, are equipped with the Multitronic® 01J (VL300) Continuously Variable Transmission. One of the more unique features about this transmission is the fact that the Transmission Control Module (TCM) is located ***INSIDE*** the transmission with the 25 pin TCM connector protruding out the rear of the unit.. This transmission does not use a torque converter, it uses a dual mass flywheel with the 1.8L engine, and a flywheel/damper plate assembly with the 3.0L engine. Another of the unique components of the 01J is the use of a drive chain instead of a belt. This is the first time a drive chain has been used in a CVT application.
The TCM operates several external relays through the same harness as the one that connects to the back of the transmission case. The TCM also communicates with other modules over the CAN Network.
The Tiptronic gear selection feature provides six (6) manually selected speeds.

AUDI MULTITRONIC 01J CVT

PRELIMINARY INFORMATION

Refer to Figure 1 for TCM connector location and terminal functions.

Refer to Figure 2 for Internal Component identification.

Refer to Figure 3 for Speed Sensor description.

Refer to Figure 4 for Transmission Range Sensor and Fluid Temperature Sensor description.

Refer to Figure 5 for Pressure Sender description.

Refer to Figure 6 for Transmission Solenoid description.

Refer to Figure 7 for Valve Body valve identification.

Refer to Figure 8 for TCM Controlled External Component identification.

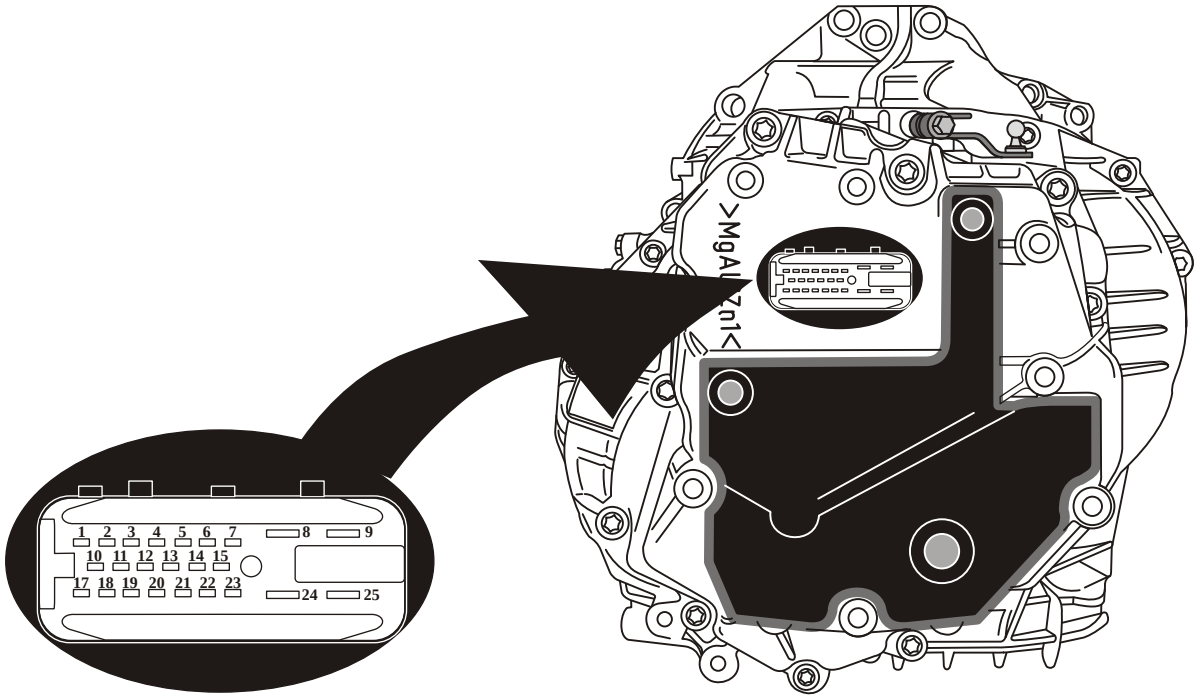
Refer to Figure 9 for CAN BUS Communication information.

Refer to Figure 10 for Fault Indication information.

Refer to Figure 11 for 01J Transmission Specifications.

Transmission Digest

TCM CONNECTOR LOCATION & TERMINAL FUNCTIONS



The Transmission Control Module J217
25 pin compact connector

Two terminals are used in the TCM's 25 pin compact connector to connect to the CAN bus network system known as the Drivetrain CAN Bus Low and Drivetrain CAN Bus High. Hard wired directly into the 25 pin connector is an Engine Speed Signal on terminal 15. The hard input is the priority line for engine RPM data. It is a key parameter for the slip control feature of the forward and reverse clutch. The Engine RPM data that the TCM receives over the CAN bus is a redundancy (back-up) signal.

Terminals 12 (upshift), 13(recognition) and 14 (downshift) are inputs to the TCM from the Tiptronic Console Shifter.

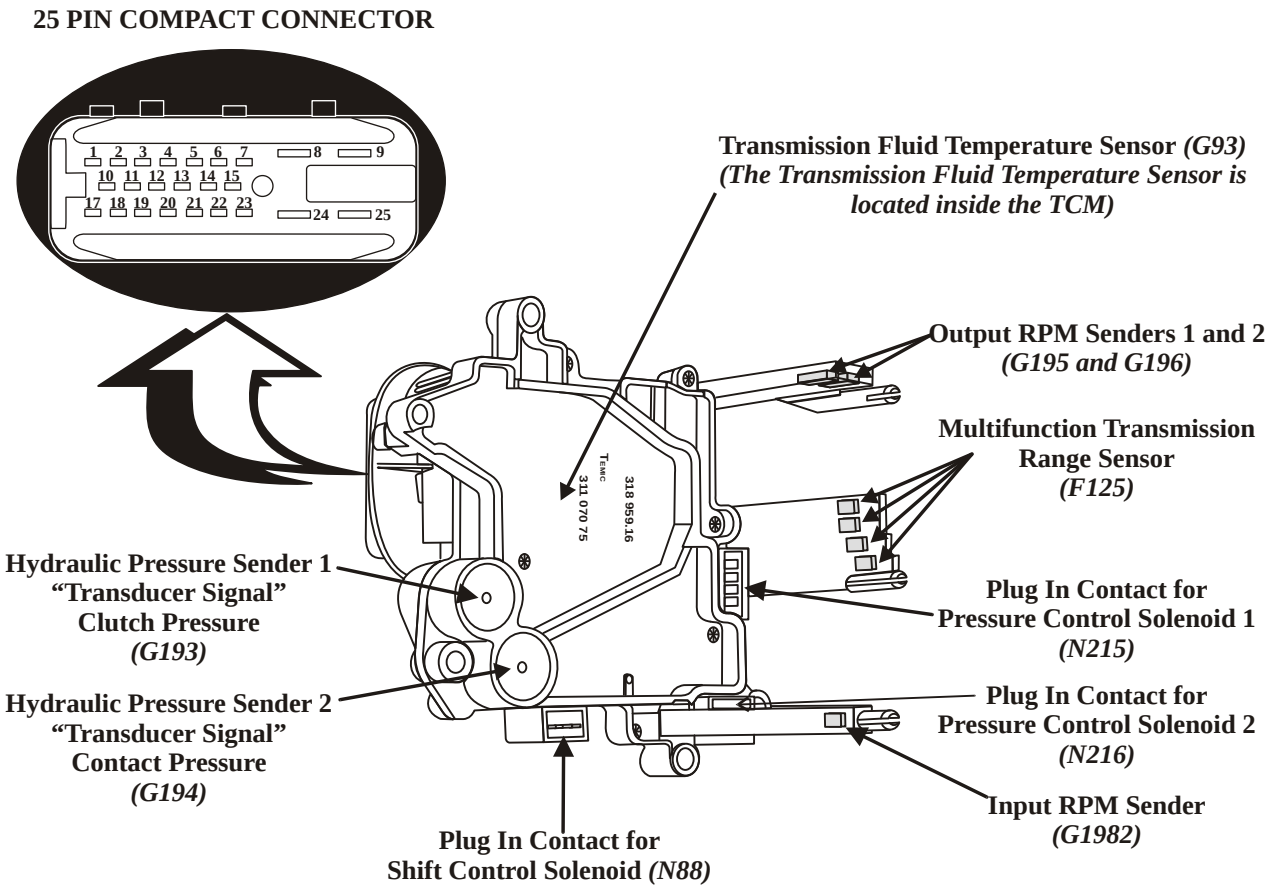
Pin 6 is a shift indicator signal sent out by the TCM
Pin 5 is a vehicle speed signal sent out by the TCM
Pin 2 is the diagnosis and programing interface wire

These specific data signals are also sent into the CAN bus network system from the TCM.

Other connections to the TCM's 25 pin compact connector are power and grounds, the Park/Neutral Position Relay, the Shift Lock Solenoid

Figure 1

MULTITRONIC ® TCM COMPONENT IDENTIFICATION



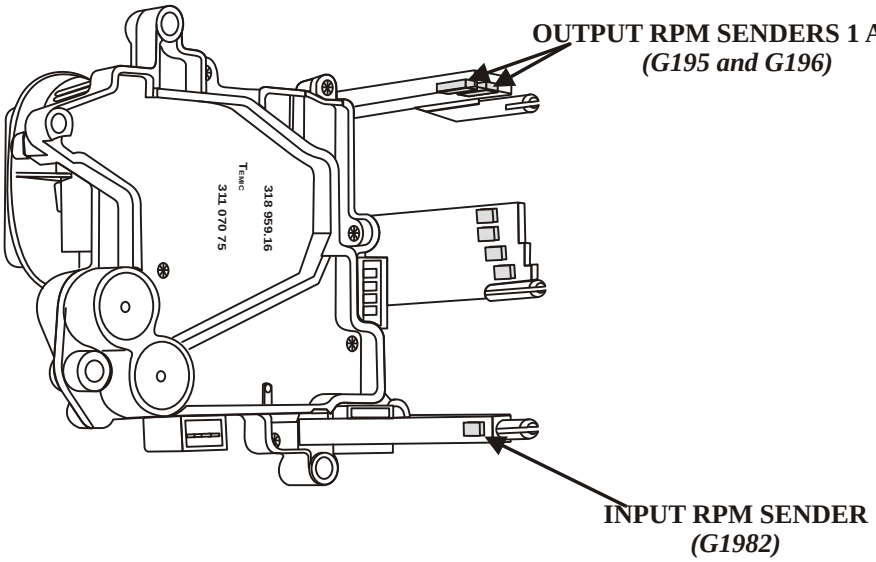
Located inside the Multitronic® unit is the ***Transmission Control Module (TCM)***. Incorporated into the TCM are two hydraulic pressure transducers. Also incorporated into the unit are Hall Effect Sensors used for RPM readings and manual valve selection. The TCM uses robust plug-in gooseneck connectors to snap into the three solenoids that are fitted into the valve body housing. This special electrical feature of the TCM being integrated into the transmission eliminates the need for wiring. This allows the unit to be impervious to electromagnetic interference and with the Hall Effect sensors being free of mechanical wear, the durability and reliability of the TCM's system increases significantly.

As a result of this integrated system, testing of the solenoids and RPM signals can not be accomplished with the use of a scope or DVOM. A scan tool will need to be used to observe its data stream.

The TCM is connected to a CAN bus system through its 25 pin compact connector where information is exchanged over the network between the ECM and ABS control module. The TCM receives data rom the ECM such as, but not limited to; the Engine speed signal, cruise control, coolant temperature, accelerator pedal position, kickdown information, brake switch information, intake air temp, altitude information and AC compressor status. The TCM also receives data from the ABS control module such as but not limited to; individual wheel speed signals and ABS activity.

Figure 2

THE TRANSMISSION CONTROL MODULE J217
HALL EFFECT SENSORS



The ***RPM Hall Effect Sensors*** are mounted in the TCM and reach past the valve body. The Input RPM sensor reads a signal off of a sender wheel containing 40 equally spaced magnets. This registers the rotation speed of pulley set 1 (the drive pulley) which represents actual transmission input speed. It is used together with engine speed data for clutch control.

Output RPM Sender 1 and Sender 2 read a signal off of a sender wheel containing 32 equally spaced magnets. Output RPM Sender 1 registers the rotation speed of pulley set 2 (the driven pulley) to be used as output speed. Transmission output speed is used for transmission control, slip control and for a hill-hold function.

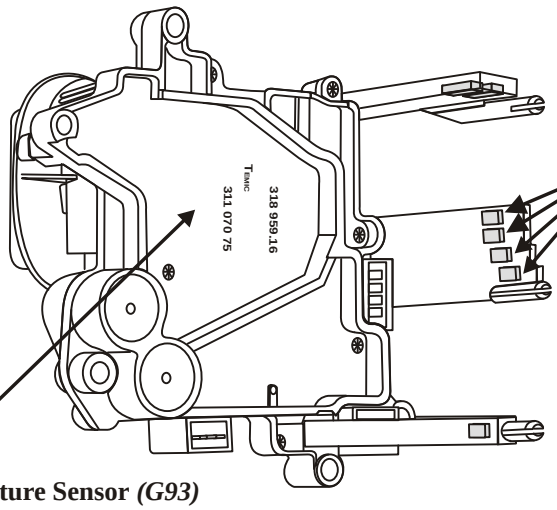
The positions of Sender 1 and 2 is offset so that the phase angles of the senders are 25% out of phase with one another. This allows Sender 2 to be used to recognize forward or reverse rotation. If the signal from the Output Sender 1 is lost, the output speed will be determined by sender 2.

If both fail, a substitute value is generated from the information available from the wheel speeds across the CAN bus.

With any combination of output speed data failure, the hill-hold feature is eliminated.

Figure 3

THE TRANSMISSION CONTROL MODULE J217
RANGE SENSOR/HALL EFFECT SENSORS &
TRANSMISSION FLUID TEMPERATURE SENSOR



MULTIFUNCTION TRANSMISSION RANGE SENSOR (F125)

Transmission Fluid Temperature Sensor *(G93)*
(The Transmission Fluid Temperature Sensor is located inside the TCM)

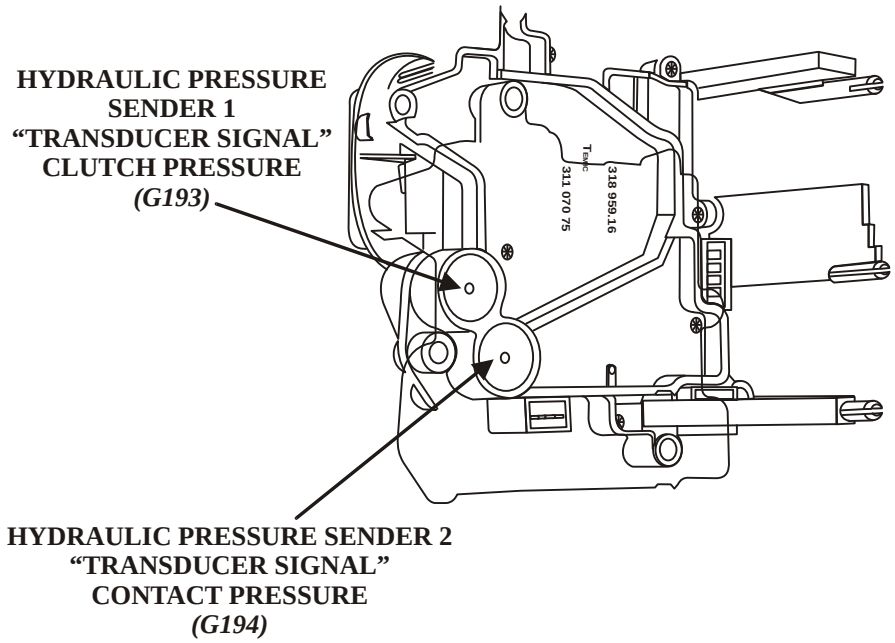
The ***Multifunction Transmission Range Sensor*** has four Hall Effect Sensors which are controlled by a magnetic gate located in the rooster comb area of the selector shaft. The signals from the sensors are interpreted in the same way as the positions of mechanical switches either open or closed. With 4 sensors, 16 total open and closed combinations can be obtained. 6 combinations are used to inform the TCM of a Park, Reverse, Neutral and Drive manual valve selection as well as intermediate movement positions from Park to Reverse and a Reverse to Neutral to Drive movement. The other 10 possible combinations are reserved as being faulty.

The ***Transmission Fluid Temperature Sensor*** is integrated into the circuit board ***inside*** the TCM. It records the temperature of the TCM aluminum mounting frame which is in close proximity to the actual fluid temperature.
Transmission oil temperature influences clutch control and transmission input speed control and adaptation functions. If the fluid temperature sensor fails, engine temperature is used to calculate a substitute value.To protect the transmission, engine performance will be reduced gradually until the engine is at idle.

Figure 4

THE TRANSMISSION CONTROL MODULE J217
PRESSURE SENDERS

Pressure Sender 1 registers clutch pressure of the forward and reverse clutches and is used to monitor clutch function. This clutch pressure monitoring has a high priority so malfunction of this sender usually causes the failsafe valve to be activated. The safety valve is activated by Shift Control Solenoid N88.



Pressure Sender 2 registers contact pressure which is regulated by a torque sensor. It is used to control clutch slip based on torque input. Therefore, contact pressure will be proportional to input torque. If this sender fails, the slip control adaptation is deactivated. Slip torque is then controlled by means of stored values.

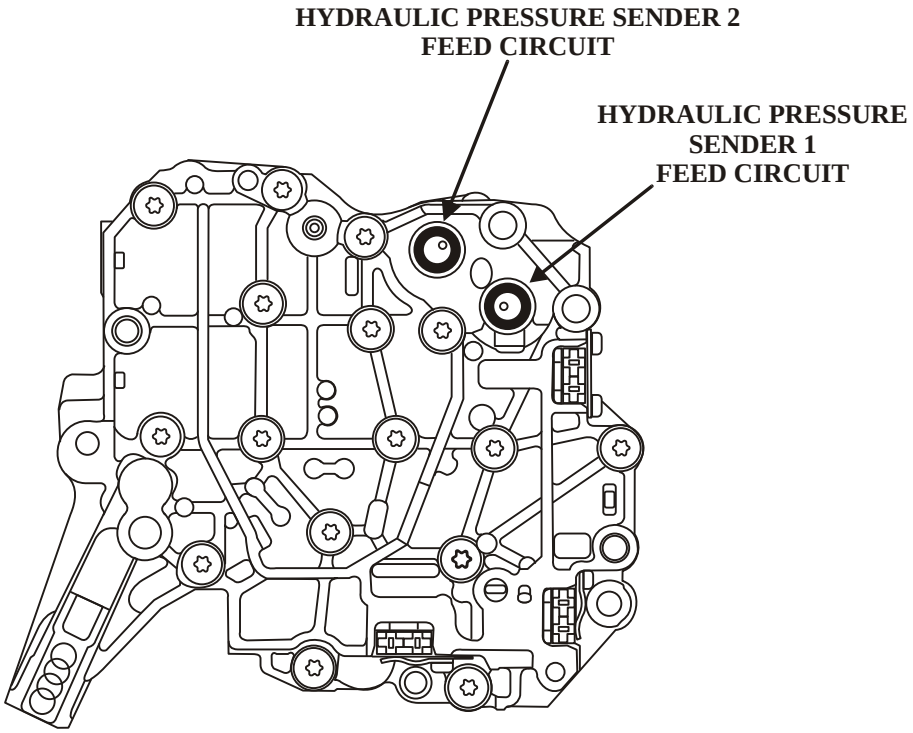


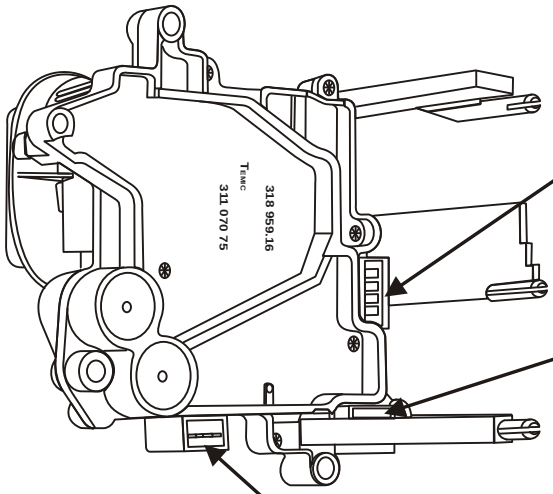
Figure 5

THE TRANSMISSION CONTROL MODULE J217
SOLENOIDS

The TCM calculates nominal clutch pressure from inputs such as Engine RPM, Transmission Input Speed, Accelerator Pedal Position, Engine Torque, Brake Signal and Transmission Fluid Temp. From these parameters the TCM controls the current to ***Pressure Control Solenoid 1***.

Pressure Control Solenoid 2 influences the position of the Hydraulic Reduction Valve which controls the Variator (Pulley Pressure) for ratio changes.

The Shift Control Solenoid is used to control the cooling valve and the safety valve.



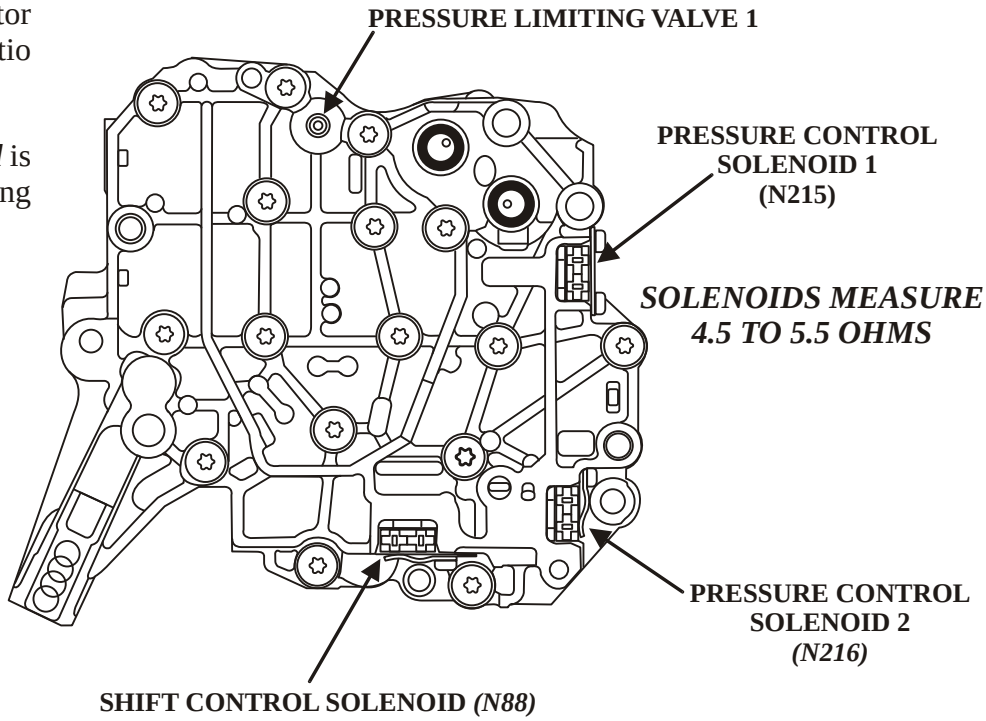


Figure 6

VALVE BODY VALVE IDENTIFICATION AND LOCATION

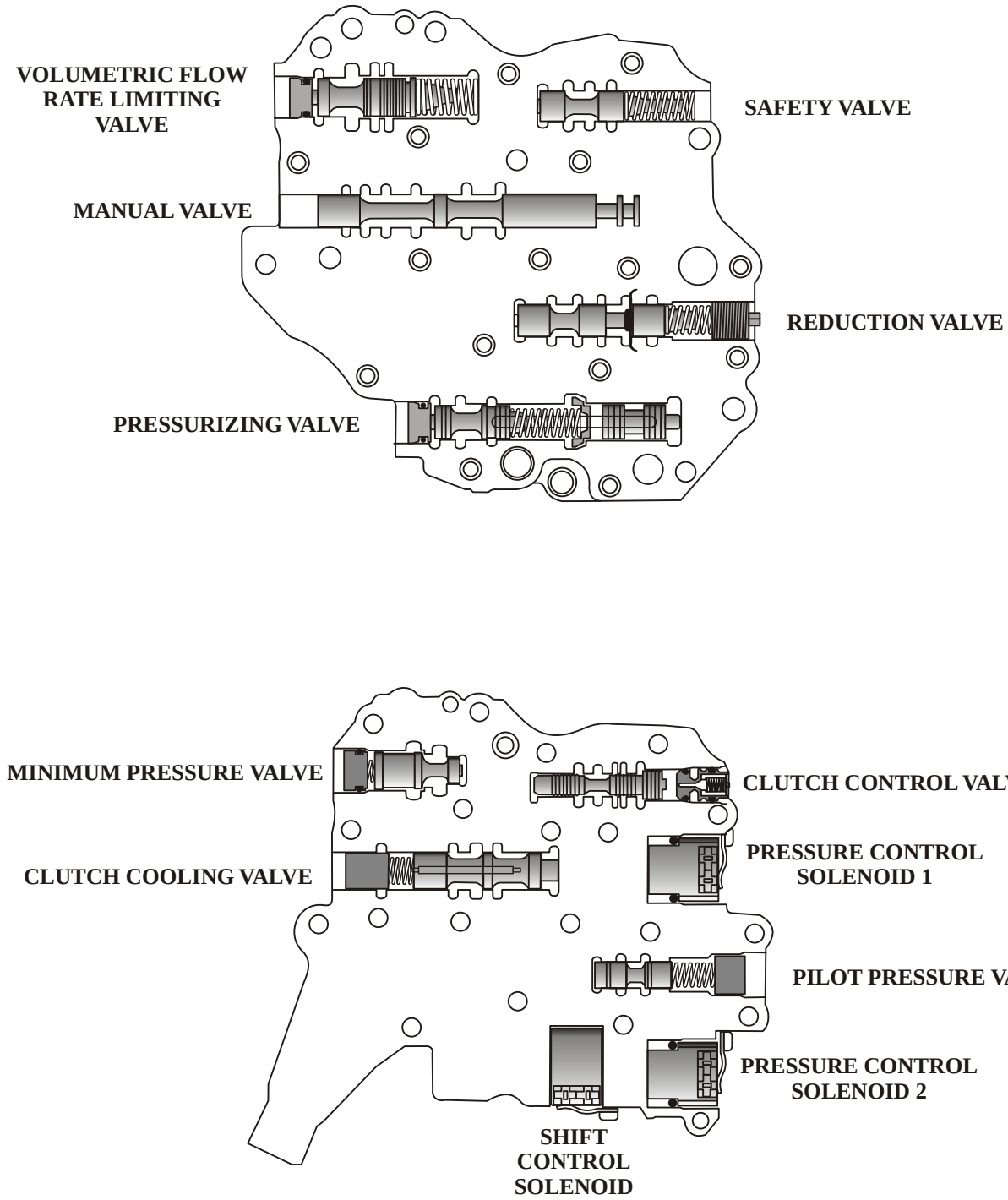
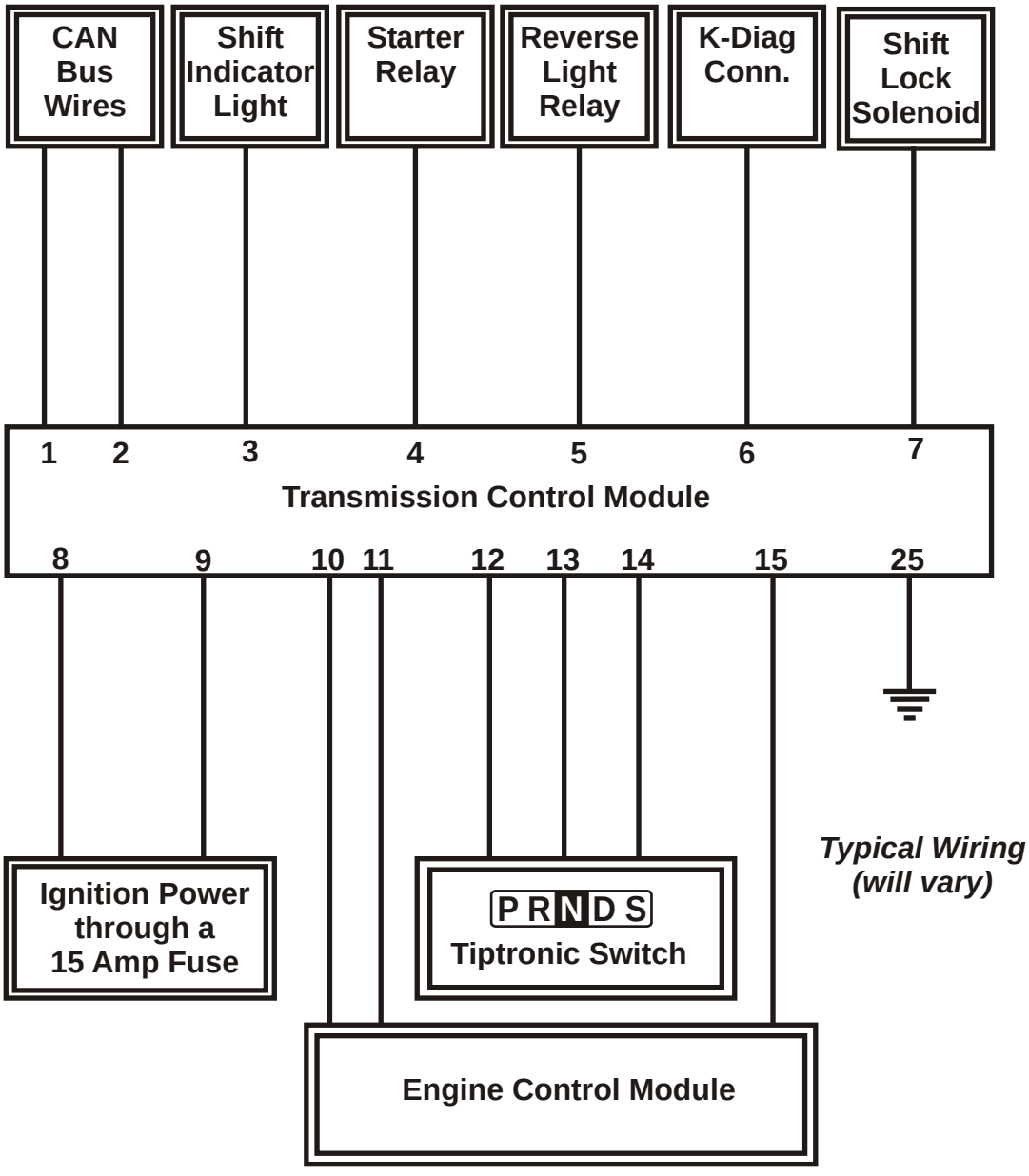


Figure 7

THE TRANSMISSION CONTROL MODULE J217
EXTERNAL CIRCUITS & COMPONENTS



Power and ground are supplied through the vehicle harness that plugs into its 25 pin connector. The TCM operates several external relays through this harness as well as the Shift Lock Solenoid. It has dedicated lines to send a road speed signal and receive an engine speed signal. It also interfaces with other computers on the CAN network.

Figure 8

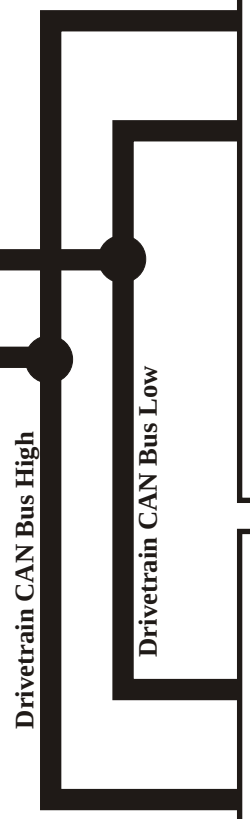
CONTROLLER AREA NETWORK (CAN) INTERFACE

Information Sent by the Motronic Engine Control Module (J220) to (and evaluated by) the Transmission Control Module (J217)

Engine Speed
Specified Idling speed
Actual Engine Torque
Coolant Temperature
Kickdown Information
Accelerator Pedal Position
Brake Light Switch
The Brake Vacuum Vent Valve
Intake Air Temperature
Cruise Control Speed (CCS) Status
CCS Specified Road Speed
Altitude Information
Air Conditioner Compressor Status
Emergency Running Program
(Information on Self-Diagnosis)

Information Sent by the Transmission Control Module (J217)

Specified Engine Torque
Specified Idling speed
Enable Adaptation - Idling Speed
Charge Regulation
Overrun Shut-Off Support
Clutch Protection
Clutch Status
Clutch Torque
Gear Shift Operation - Active/Inactive
Compressor Switch Off
Selector Lever Position/Drive Position
Vehicle Road Speed
Shift Indicator
Currently Engaged Gear or
Target Gear
Coding in the Motronic Engine
Control Module J220
Energy Running Program (Information
on Self-Diagnosis)
On-Board Diagnosis Status



Information Sent by the ABS Control Module with EDL/ASR/ESP (J104) to (and evaluated by) the Transmission Control Module (J217)

ASR Request
EBC Request
ABS Application
EDL Intervention
ESP Intervention
Wheel Speed, Front Left
Wheel Speed, Front Right
Wheel Speed, Rear Left
Wheel Speed, Rear Right

The Transmission Control Module (J217), sends and receives information over the Controller Area Network (CAN), to the Motronic® Engine Control Module (J220) and to the ABS Control Module (J104) for evaluation.
The ECM and ABS modules are the only modules the TCM interfaces with over the network. Signals that travel between these three (3) modules are Engine Speed Signal, Shift Indicator Signal, Road Speed Signal, Diagnosis and programming interface, Tiptronic Recognition Signal, Tiptronic Downshift Signal and Tiptronic Upshift Signal.

Figure 9

FAULT INDICATION

The fault is stored and a substitute program enables continued operation of the vehicle with some restrictions. The fault is not indicated to the driver, since it is not critical with regard to safe operation of the vehicle. However, the vehicle will not operate properly.

CATEGORY 1 - CODES STORED; NO DISPLAY CHANGE

The fault is stored and a substitute program enables continued operation of the vehicle with some restrictions. The Selector Lever Position Indicator also indicates the presence of a fault by ***inverting the display.*** The situation is not critical for the safe operation of the vehicle, however, the vehicle will not operate properly.

CATEGORY 2 - CODES STORED; DISPLAY INVERTED

The fault is stored and a substitute program enables continued operation of the vehicle with some restrictions, at least until it stops. The Selector Lever Indicator Lever indicates the presence of a fault by ***flashing***. This state is critical with regard to safe vehicle operation. Therefore, driving the vehicle is not recommended.

CATEGORY 3 - CODES STORED; DISPLAY INVERTED AND FLASHING

When the Multitronic® system detects a fault, the selector lever position indicator in the instrument cluster will inform the driver in one of three ways, depending on the type of fault. In some cases when the display is flashing, vehicle operation will only be maintained until the next time the vehicle stops. The vehicle can no longer be driven. In other cases, vehicle operation can be resumed by restarting the vehicle.

Figure 10

Helc-Axiline

MULTITRONIC® 01J SPECIFICATIONS

Designation:	multitronic® 01J
Factory designation:	VL 30
Code:	DZN
Maximum Transferable Torque:	Maximum 229 lbs-ft (310 Nm)
Range of Ratios of the Variator:	2:40:1 to 0.40:1
Spread:	6
Ratio of Auxiliary Reduction Gear Step:	51/46 = 1.109:1
Final Drive Ratio:	43/9 = 4.778:1
Operating Pressure of Oil Pump:	MAXIMUM approximately 870 PSI (6000kPa)
ATF for multitronic®:	G 052 180 A2
Axle Oil for multitronic®:	G 052 190 A2
Fluid Quantities:	
ATF new filling:	7.9 quarts (7.5 liters)
ATF change:	4.8 quarts (4.5 liters)
Axle Oil:	1.4 quarts (1.3 liters)
Gross Weight (without flywheel):	194 lbs (88 kg)
Overall Length:	24” (610mm)

Figure 11

VOLKSWAGEN "O1M"
VALVE BODY CHANGES FOR 1998 & UP

CHANGE: Sometime in the model year for 1998, the valve body assembly was redesigned, on vehicles equipped with the O1M transaxle.

REASON: For better reliability and durability.

PARTS AFFECTED:

(1) UPPER VALVE BODY SPACER PLATE: The new design spacer plate has a hole reduced to provide an orifice in the K1 apply circuit, as shown in Figure 2.
(2) 2-3 TIMING VALVE: The valve and bore plug were redesigned to move the spring to the opposite side of the valve, as shown in Figures 4 and 5. The spring was also dimensionally changed. See Figure 6 for Spring Specs.
(3) K1 CLUTCH REGULATING VALVE: The valve was redesigned on the end opposite of the spring to slow down the valves reaction to EV5 solenoid. The bore plug and retainer were changed from a 1 piece plastic, to a plug and retaining pin. See Figures 4 and 5. The spring was also redesigned to accommodate the changes to the valve. See Figure 6 for Spring Specs.
(4) VALVE BODY UPPER SIDE: The upper valve body casting changed to accommodate the changes in the EV5 solenoid hydraulic circuit, as shown in Figure 7. A checkball was added to the K1 clutch apply circuit, as shown in Figure 8. See Figures 11 and 12 for partial hydraulic schematics which will show the main hydraulic differences between 95-97 and 98& up valve bodies.
(5) VALVE BODY LOWER SIDE: The lower valve body casting changed to accommodate the 2-3 Timing valve and K1 Clutch regulating valve hydraulic circuit changes. See Figure 9. See Figures 11 and 12 for partial hydraulic schematics which will show the main hydraulic differences between 95-97 and 98& up valve bodies.
(6) LOWER VALVE BODY SPACER PLATE: The new design spacer plate has one hole added and two holes eliminated to accommodate the changes in the 2-3 timing and the K1 clutch regulating valve line-ups. See Figure 3.
(7) CHANNEL PLATE: The channel plate has two holes added to it as shown in Figure 10.

INTERCHANGEABILITY:

The late 1998 and up valve body will retro fit back to some earlier models, as a complete assembly.

Special Note: ATSG has found that when using this valve body on some earlier applications, a flair on the 3-4 up-shift may occur. This may be caused by computer software differences.

AUDI AND VOLKSWAGEN 98 & UP 01M VALVE BODY

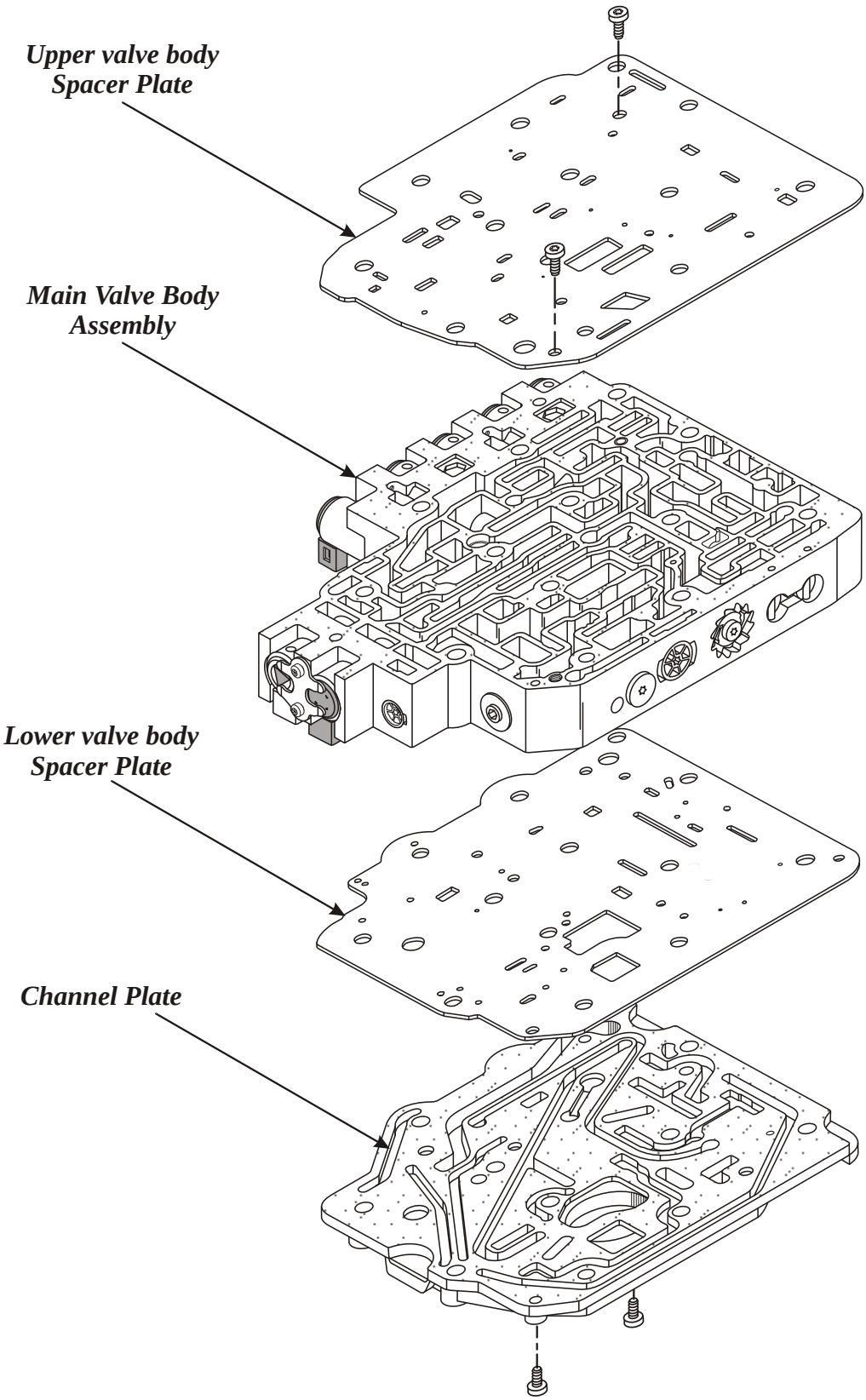
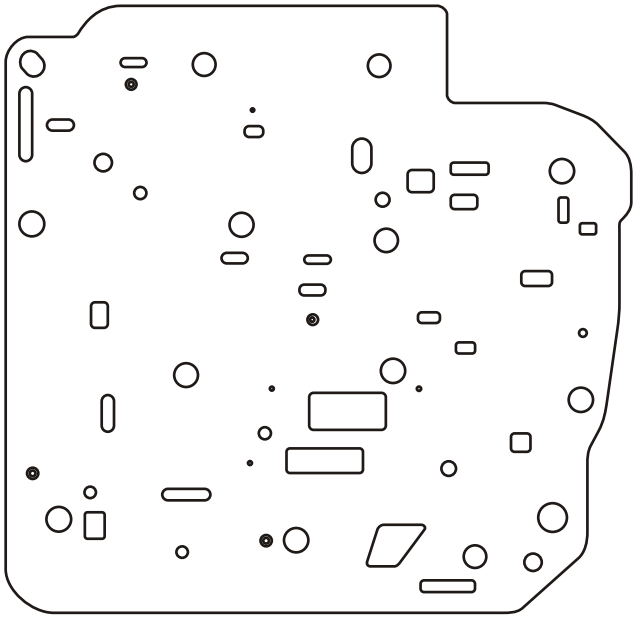
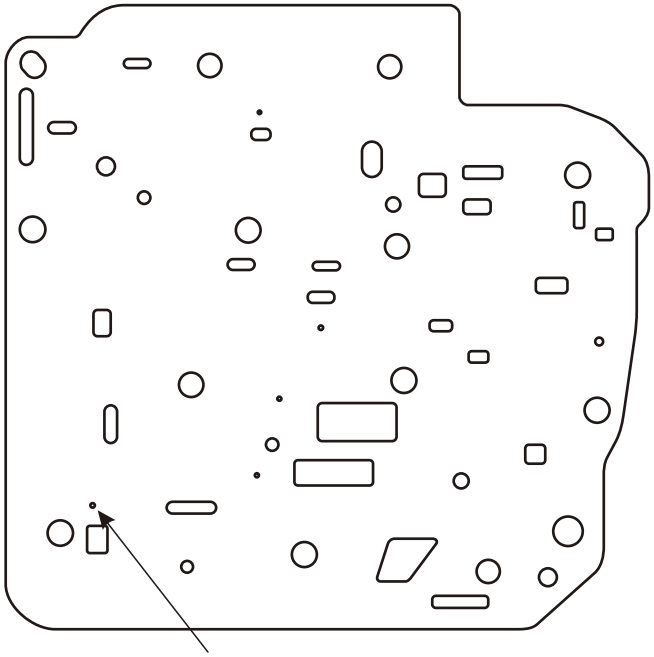


Figure 1

1995-97 UPPER SPACER PLATE



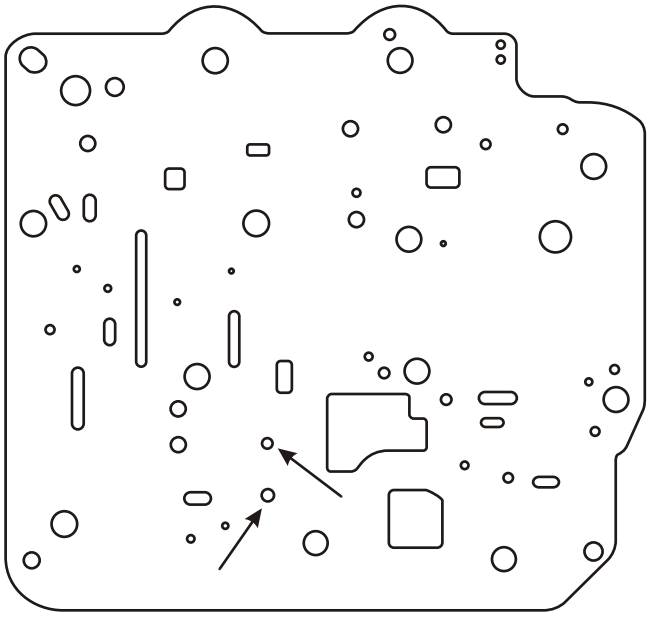
1998 & LATER UPPER SPACER PLATE



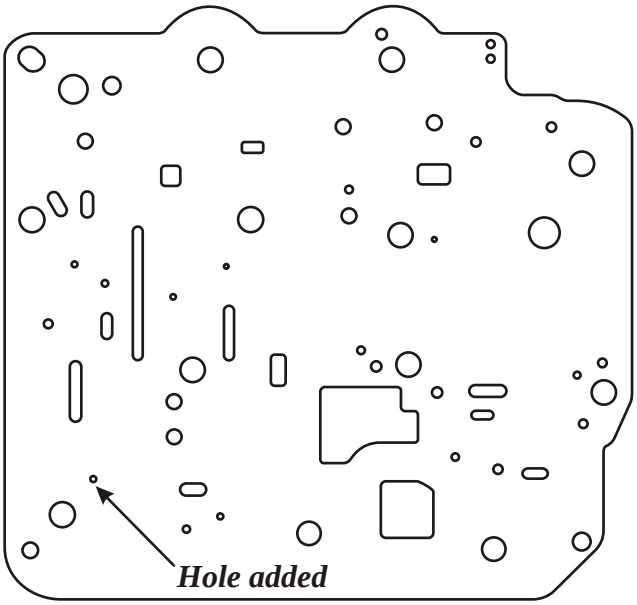
Hole diameter reduced to .059"

Figure 2

1995-97 LOWER SPACER PLATE



1998 & LATER LOWER SPACER PLATE

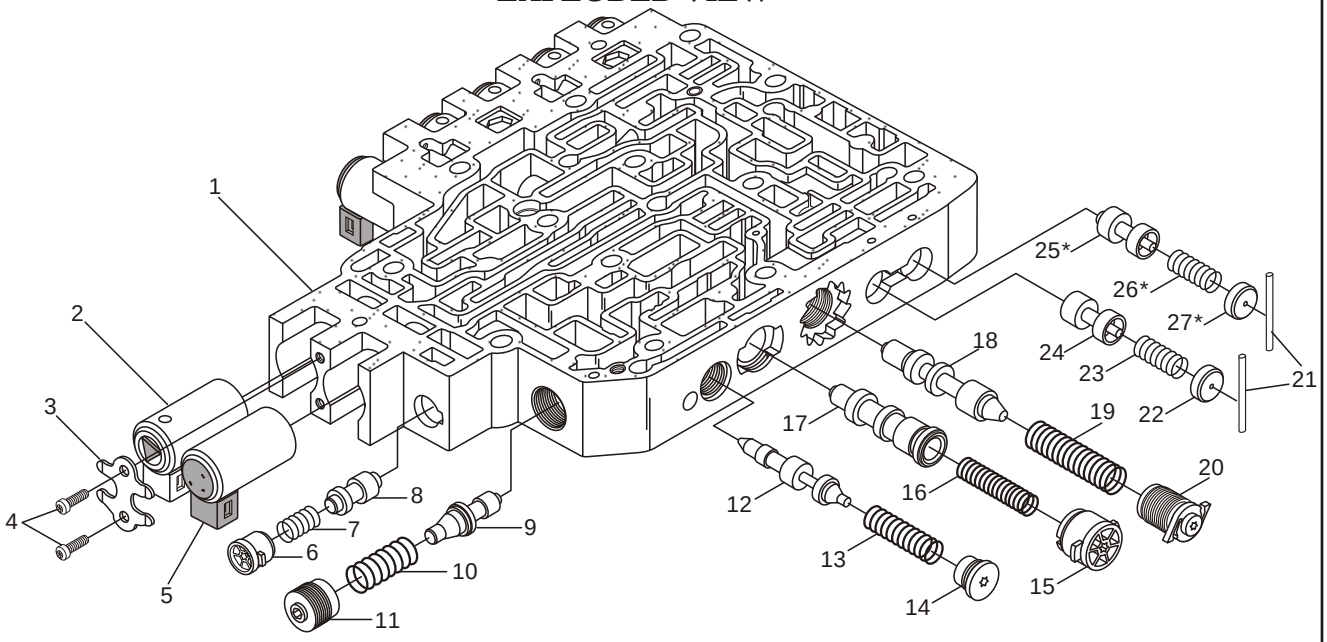


Hole added

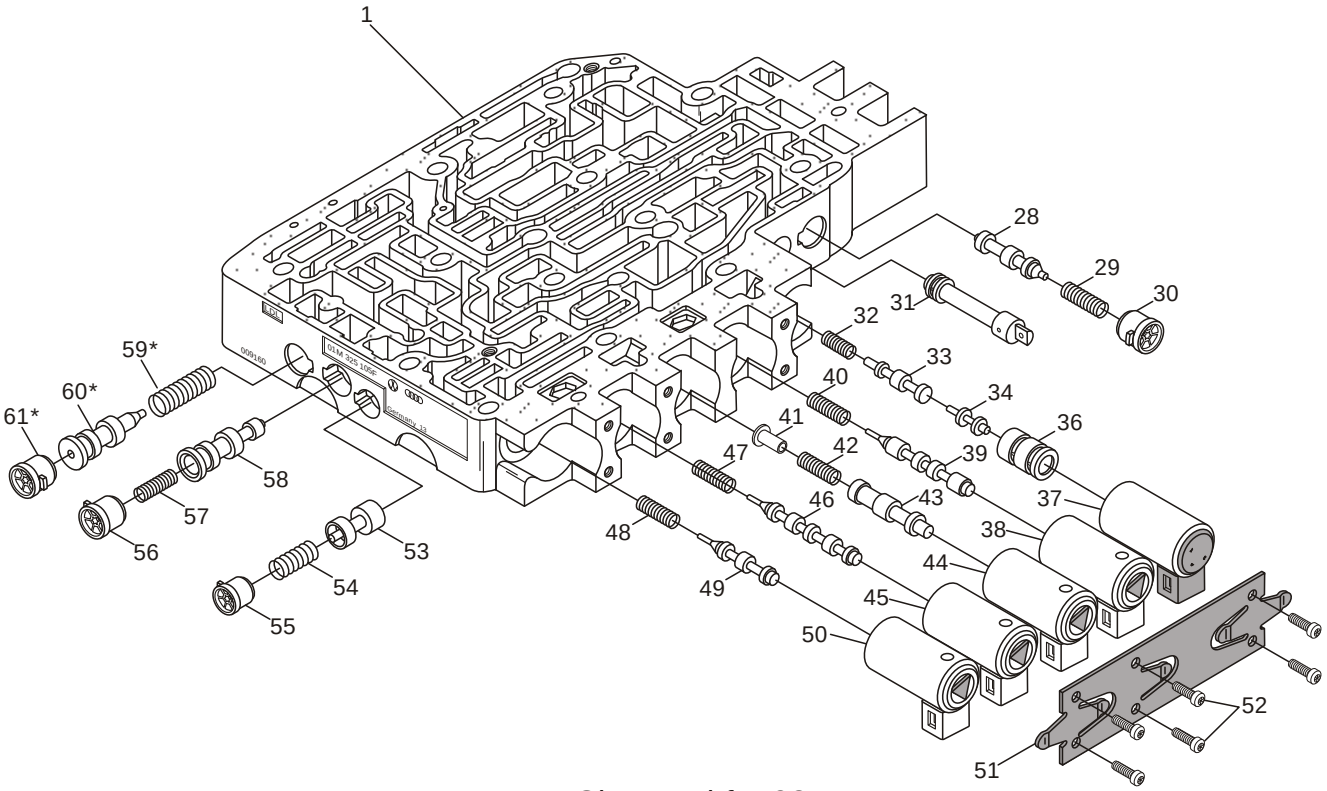
NOTE: The two holes identified with arrows on 1995-97 are eliminated on 98 & later.

Figure 3

AUDI AND VOLKSWAGEN 98&UP 01M VALVE BODY
EXPLODED VIEW



Note: Refer to page 81 for the legend and page 82 for spring specifications.



* Changed for 98

Figure 4

1. MAIN VALVE BODY CASTING
2. EV-7 SOLENOID (N94)
3. SOLENOID RETAINING BRACKET
4. SOLENOID RETAINING BRACKET BOLTS
5. EV-6 SOLENOID (N93)
6. MANUAL 1ST LOCKING VALVE RETAINER (YELLOW)
7. MANUAL 1ST LOCKING VALVE SPRING (SEE SPRING SPEC)
8. MANUAL 1ST LOCKING VALVE
9. SOLENOID REGULATOR VALVE
10. SOLENOID REGULATOR VALVE SPRING (SEE SPRING SPEC)
11. SOLENOID REGULATOR VALVE RETAINER
12. CONVERTER REGULATOR VALVE
13. CONVERTER REGULATOR VALVE SPRING (SEE SPRING SPEC)
14. CONVERTER REGULATOR VALVE RETAINER
15. MAIN PRESSURE REGULATOR VALVE RETAINER (BROWN)
16. MAIN PRESSURE REG. VALVE SPRING (SEE SPRING SPEC)
17. MAIN PRESSURE REGULATOR VALVE
18. BOOST PRESSURE REGULATOR VALVE
19. BOOST PRESSURE REG. VALVE SPRING (SEE SPRING SPEC)
20. BOOST PRESSURE REGULATOR RETAINER (ADJUSTABLE)
21. K-3 & K1 REGULATOR VALVE RETAINING PINS
22. K-3 REGULATOR VALVE BORE PLUG
23. K-3 REGULATOR VALVE SPRING (SEE SPRING SPEC)
24. K-3 REGULATOR VALVE
25. K-1 REGULATOR VALVE
26. K-1 REGULATOR VALVE SPRING (SEE SPRING SPEC)
27. K-1 REGULATOR VALVE BORE PLUG
28. MANUAL 1ST/K-3 LOCKOUT VALVE
29. MANUAL 1ST/K-3 LOCKOUT VALVE SPRING (SEE SPRING SPEC)
30. MANUAL 1ST/K-3 LOCKOUT RETAINER (YELLOW)
31. MANUAL VALVE
32. CONVERTER CLUTCH APPLY VALVE SPRING (SEE SPRING SPEC)
33. CONVERTER CLUTCH APPLY VALVE
34. CONVERTER CLUTCH CONTROL VALVE
36. CONVERTER CLUTCH CONTROL VALVE SLEEVE
37. EV-4 SOLENOID, CONVERTER CLUTCH (N91)
38. EV-3 SOLENOID (N90)
39. K-3 SHIFT VALVE
40. K-3 SHIFT VALVE SPRING (SEE SPRING SPEC)
41. B-1 APPLY VALVE SPRING SEAT
42. B-1 APPLY VALVE SPRING (SEE SPRING SPEC)
43. B-1 APPLY VALVE
44. EV-5 SOLENOID (N92)
45. EV-1 SOLENOID (N88)
46. K-1/B-1 SHIFT VALVE
47. K-1/B-1 SHIFT VALVE SPRING (SEE SPRING SPEC)
48. B-2 SHIFT VALVE SPRING (SEE SPRING SPEC)
49. B-2 SHIFT VALVE
50. EV-2 SOLENOID (N89)
51. SOLENOID RETAINING BRACKET
52. SOLENOID RETAINING BRACKET BOLTS (6)
53. B-2 REGULATOR VALVE
54. B-2 REGULATOR VALVE SPRING (SEE SPRING SPEC)
55. B-2 REGULATOR VALVE RETAINER (YELLOW)
56. K-1 CONTROL VALVE RETAINER (TAN)
57. K-1 CONTROL VALVE SPRING (SEE SPRING SPEC)
58. K-1 CONTROL VALVE
59. 2-3 TIMING VALVE SPRING (SEE SPRING SPEC)
60. 2-3 TIMING VALVE
61. 2-3 TIMING VALVE RETAINER (TAN)

Valves #25 and #60 have changed for 98 & UP

Figure 5

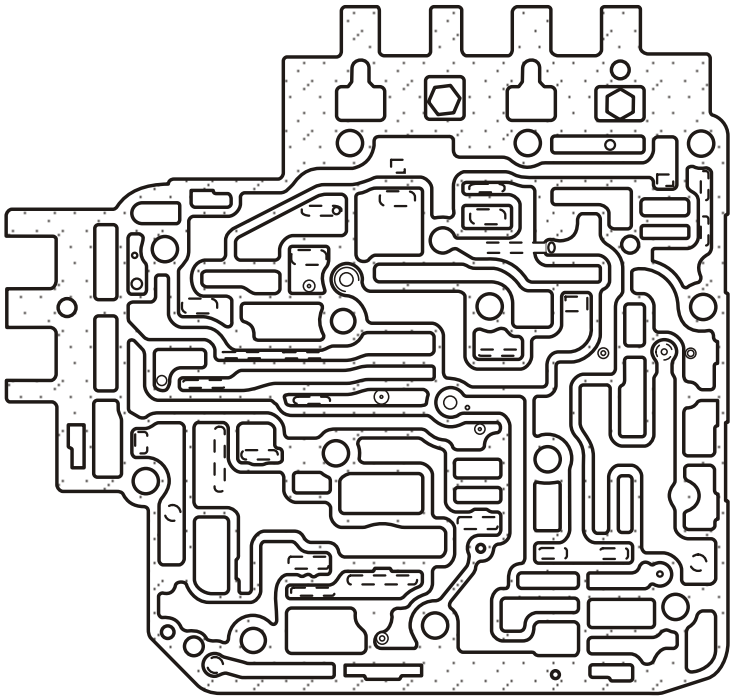
VOLKSWAGON 98 & UP"01M" SPRING SPECIFICATIONS

Main Valve Body

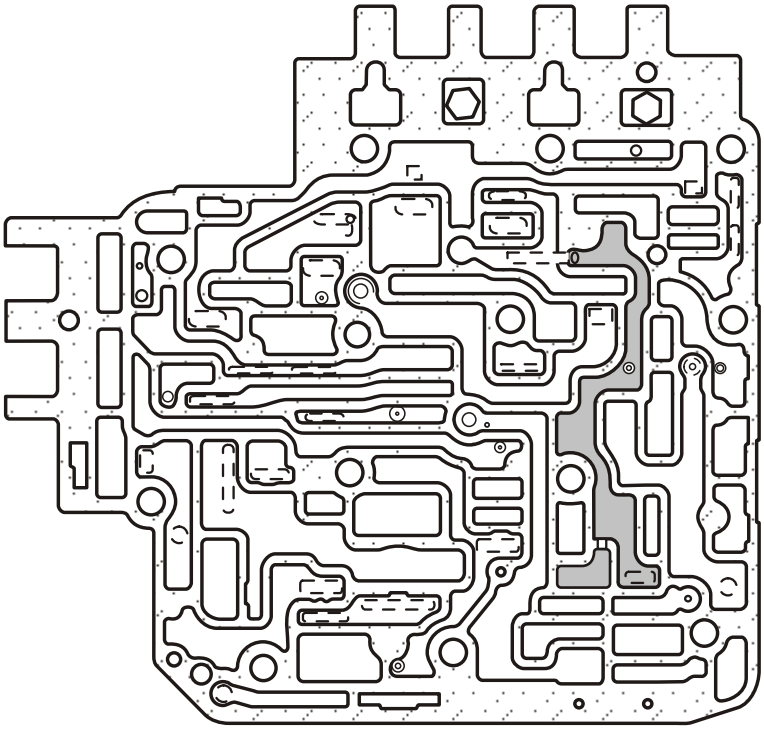
	"Back Side"	***"Front Side"***
	SPRING ILLUSTRATION NO. 7: FREE LENGTH = .690" SPRING DIAMETER = .352" WIRE DIAMETER = .029"	SPRING ILLUSTRATION NO. 29: FREE LENGTH = .960" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
	SPRING ILLUSTRATION NO. 10: FREE LENGTH = 1.315" SPRING DIAMETER = .454" WIRE DIAMETER = .039"	SPRING ILLUSTRATION NO. 32: FREE LENGTH = .600" SPRING DIAMETER = .215" WIRE DIAMETER = .020"
	SPRING ILLUSTRATION NO. 13: FREE LENGTH = 1.400" SPRING DIAMETER = .335" WIRE DIAMETER = .035"	SPRING ILLUSTRATION NO. 40: FREE LENGTH = .960" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
	SPRING ILLUSTRATION NO. 16: FREE LENGTH = 1.385" SPRING DIAMETER = .410" WIRE DIAMETER = .035"	SPRING ILLUSTRATION NO. 42: FREE LENGTH = .960" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
	SPRING ILLUSTRATION NO. 19: FREE LENGTH = 1.430" SPRING DIAMETER = .357" WIRE DIAMETER = .039"	SPRING ILLUSTRATION NO. 47: FREE LENGTH = .960" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
	SPRING ILLUSTRATION NO. 23: FREE LENGTH = 1.130" SPRING DIAMETER = .350" WIRE DIAMETER = .029"	SPRING ILLUSTRATION NO. 48: FREE LENGTH = .960" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
Changed for 98 {	SPRING ILLUSTRATION NO. 26: FREE LENGTH = .860" SPRING DIAMETER = .350" WIRE DIAMETER = .026"	SPRING ILLUSTRATION NO. 54: FREE LENGTH = 1.045" SPRING DIAMETER = .352" WIRE DIAMETER = .029"
		SPRING ILLUSTRATION NO. 57: FREE LENGTH = .936" SPRING DIAMETER = .280" WIRE DIAMETER = .027"
Changed for 98 {		SPRING ILLUSTRATION NO. 59: FREE LENGTH = 1.057" SPRING DIAMETER = .355" WIRE DIAMETER = .029"

Figure 6

1995-97 UPPER VALVE BODY WORM TRACK CONFIGURATION



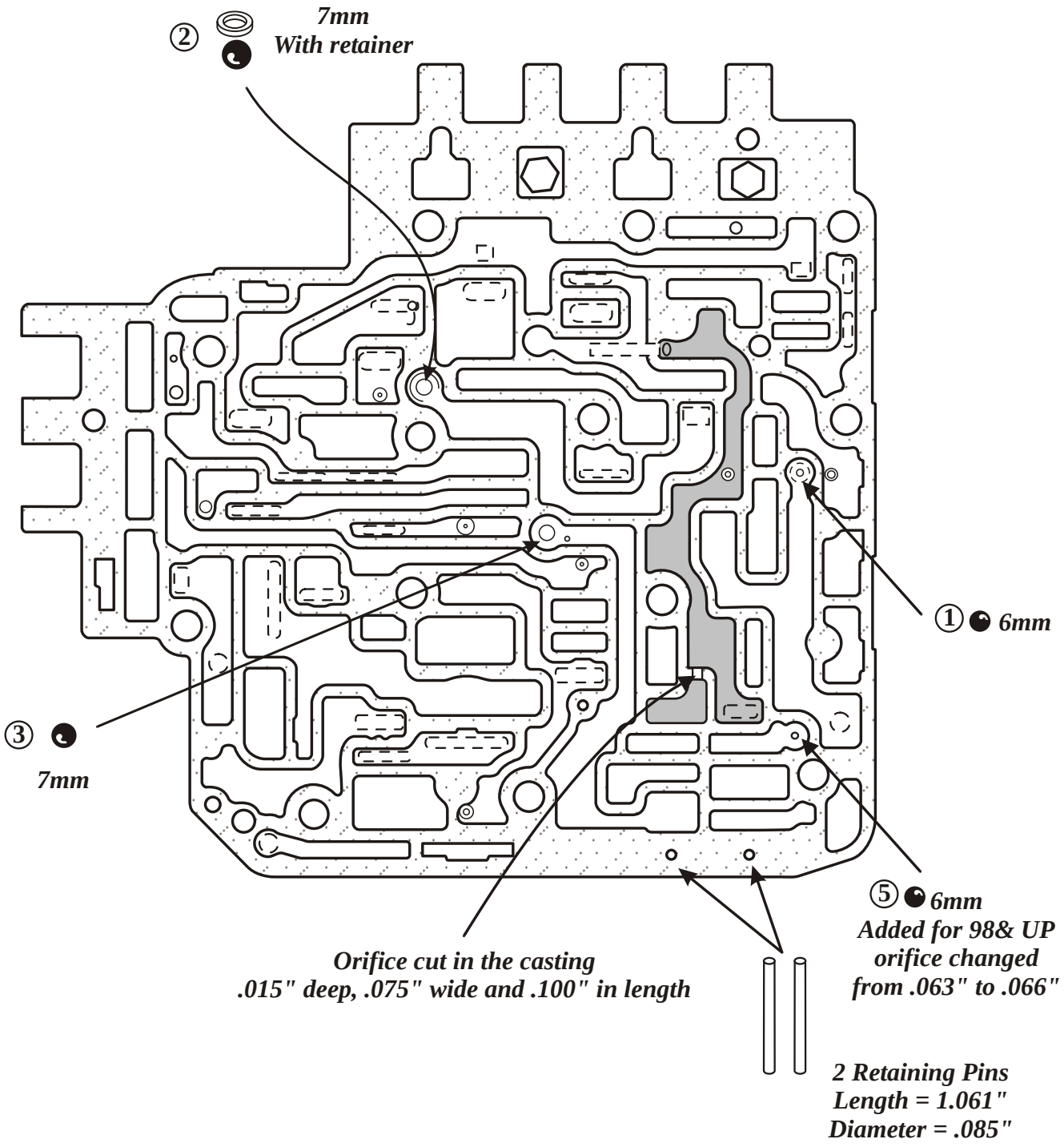
1998 & UP UPPER VALVE BODY WORM TRACK CONFIGURATION



NOTE: Casting changes are highlighted in grey

Figure 7

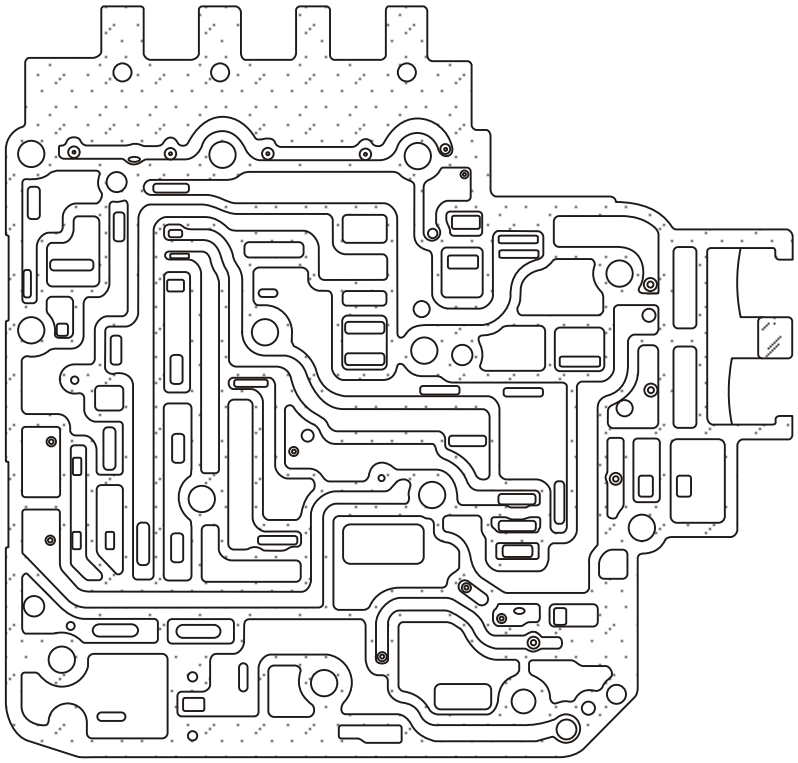
UPPER VALVE BODY
CHECKBALL LOCATIONS



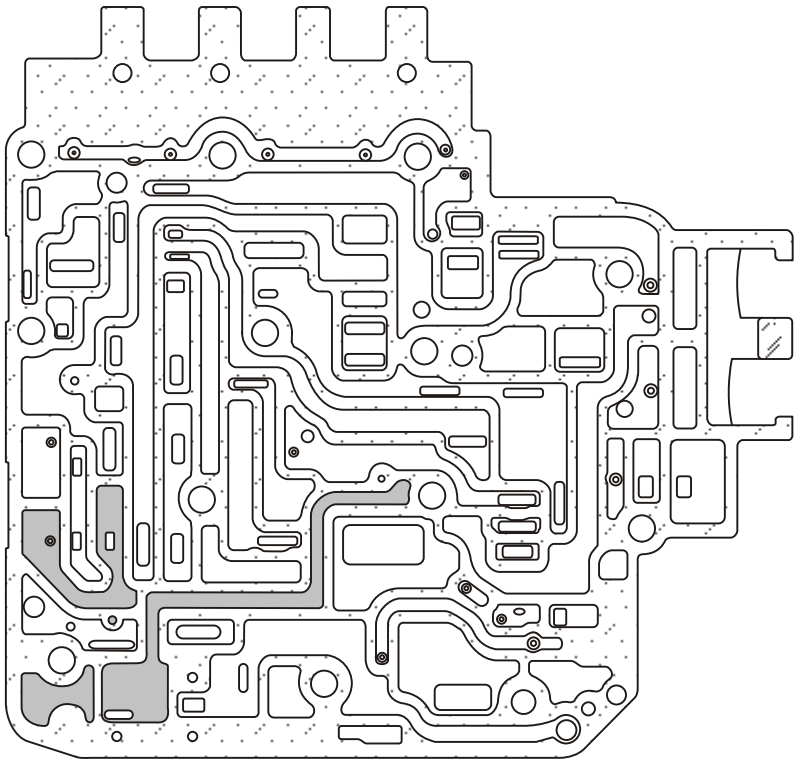
NOTE: Casting changes are highlighted in grey.
This is the EV5 solenoid hydraulic circuit.

Figure 8

1995-97 LOWER VALVE BODY WORM TRACK CONFIGURATION



1998 & UP LOWER VALVE BODY WORM TRACK CONFIGURATION



NOTE: Casting changes are highlighted in grey

Figure 9

CHANNEL PLATE
CHECKBALL LOCATIONS

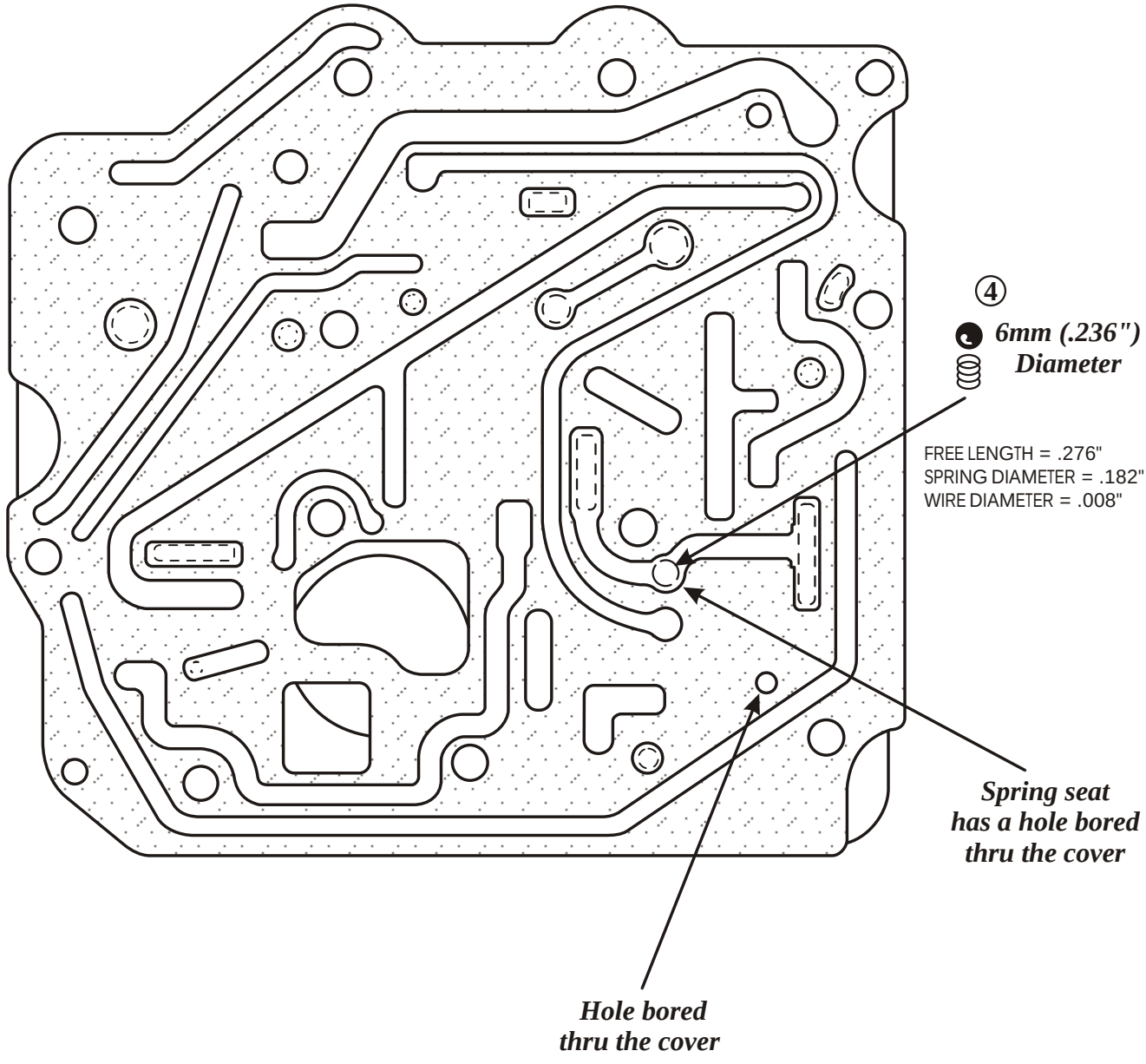


Figure 10

O1M 1995-97 PARTIAL HYDRAULIC SCHEMATIC

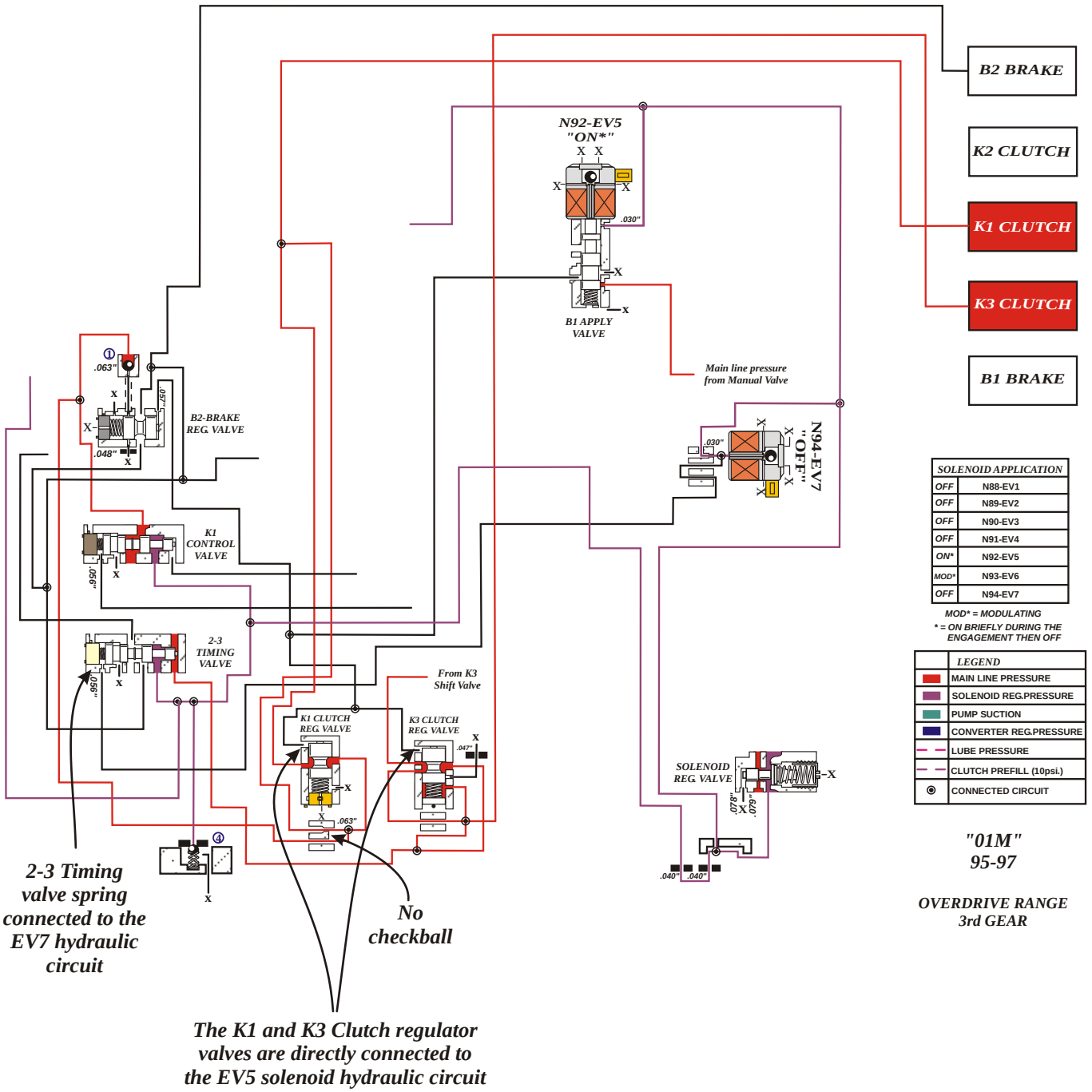


Figure 11

O1M 1998 & UP PARTIAL HYDRAULIC SCHEMATIC

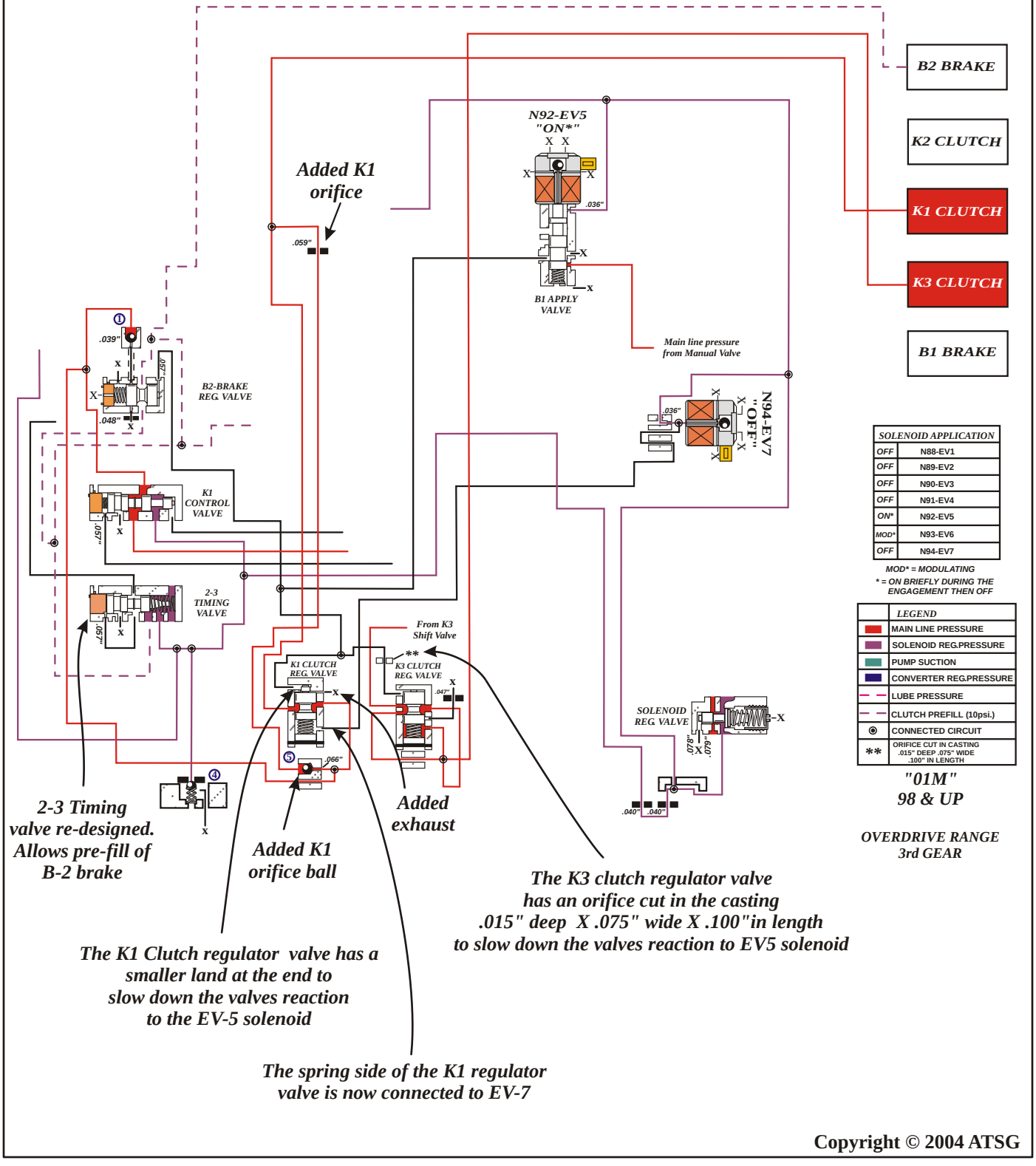


Figure 12

AUDI AND VOLKSWAGEN 01M
MULTIPLE SOLENOID CIRCUIT CODES

COMPLAINT: Audi and V.W. vehicles equipped with the 01M transaxle may exhibit multiple solenoid codes, before or after overhaul.

CAUSE: The cause may be, a faulty or broken "Ribbon strip." This ribbon strip connects all of the solenoids to the transaxle harness connector and is known to have brittle connectors.

CORRECTION: Refer to Figure 2 to check all of the ohm values to all of the solenoids. Replace the Ribbon strip as necessary. The Ribbon strip can be replaced with a new internal harness available from Rostra that has seperate wires rather than a molded harness. See Figure 1.

SERVICE INFORMATION:

INTERNAL WIRE HARNESS (***Rostra part number***).....350-0070
NOTE: This part may be purchased from multiple Transmission parts distributers only part numbers may vary.

HARNESS LOCATION

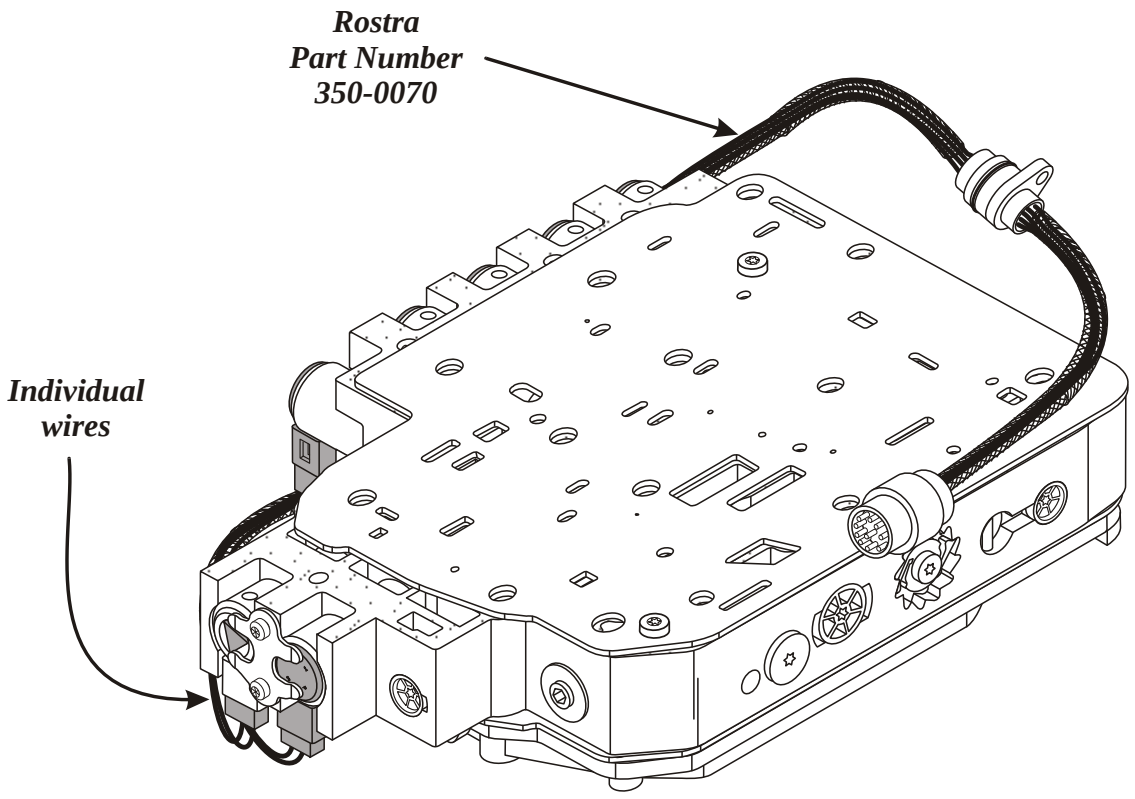
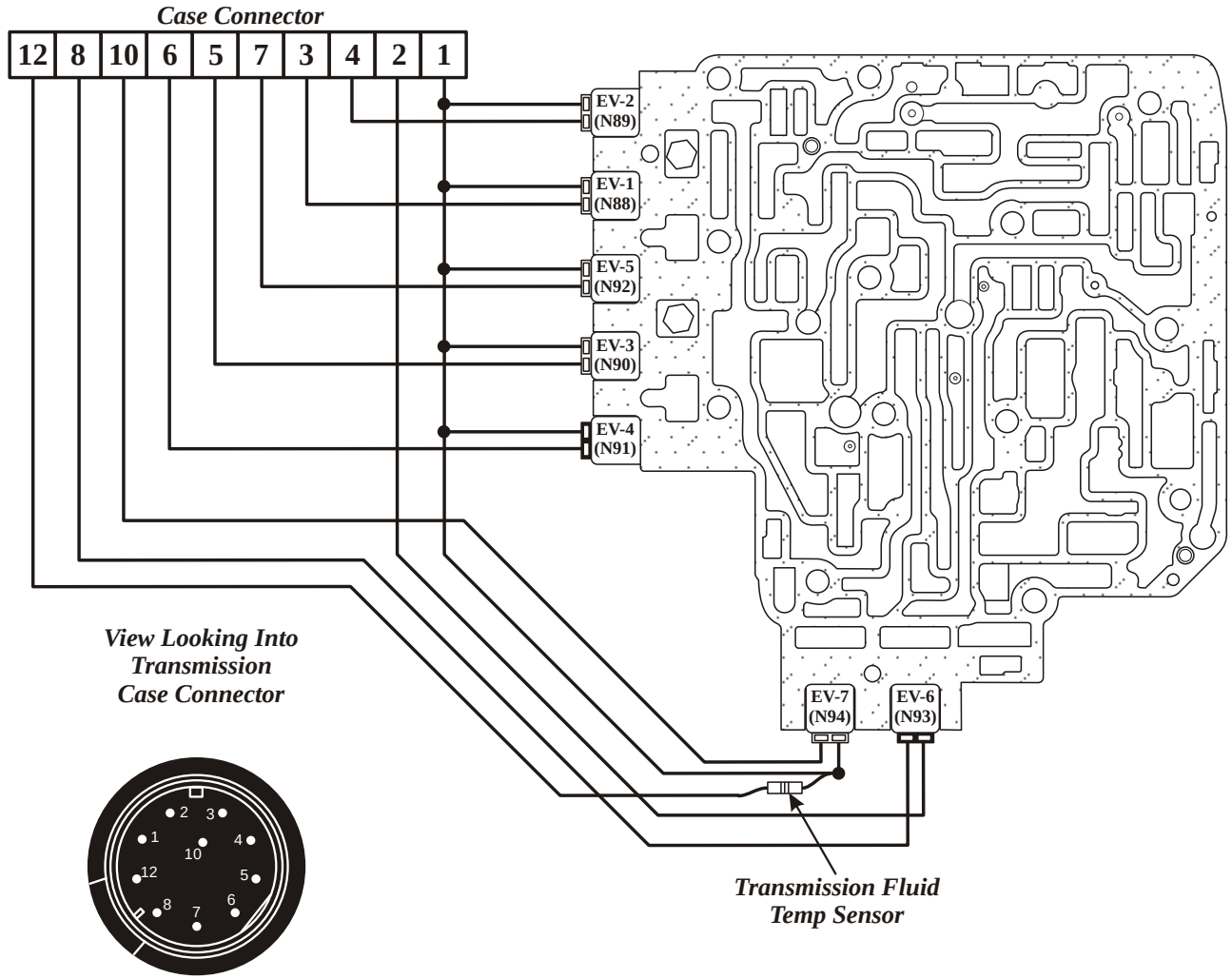


Figure 1

INTERNAL COMPONENT RESISTANCE CHART



Component	*Pin No's.*	*Resistance @ 20°C (72°F)*
Solenoid EV-1 (N88)	*1 And 3*	*55-65 Ohms*
Solenoid EV-2 (N89)	*1 And 4*	*55-65 Ohms*
Solenoid EV-3 (N90)	*1 And 5*	*55-65 Ohms*
Solenoid EV-4 (N91)	*1 And 6*	*4.5-5.1 Ohms*
Solenoid EV-5 (N92)	*1 And 7*	*55-65 Ohms*
Solenoid EV-6 (N93)	*2 And 8*	*4.5-5.1 Ohms*
Solenoid EV-7 (N94)	*1 And 10*	*55-65 Ohms*
TFT Sensor	*1 And 12*	*190k-200k Ohms*

Figure 2

THM AF23/33-5
PRELIMINARY INFORMATION

GENERAL DESCRIPTION

The AF23/33-5 transaxle is a fully automatic, five speed, electronically controlled, front wheel drive transmission, as shown in Figure 1. It consists primarily of a four element torque converter, three planetary gear sets, friction and mechanical clutches and a pressurization and control system.

The four element torque converter contains a pump, a turbine, a pressure plate assembly splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical "direct drive" coupling of the engine to the transmission.

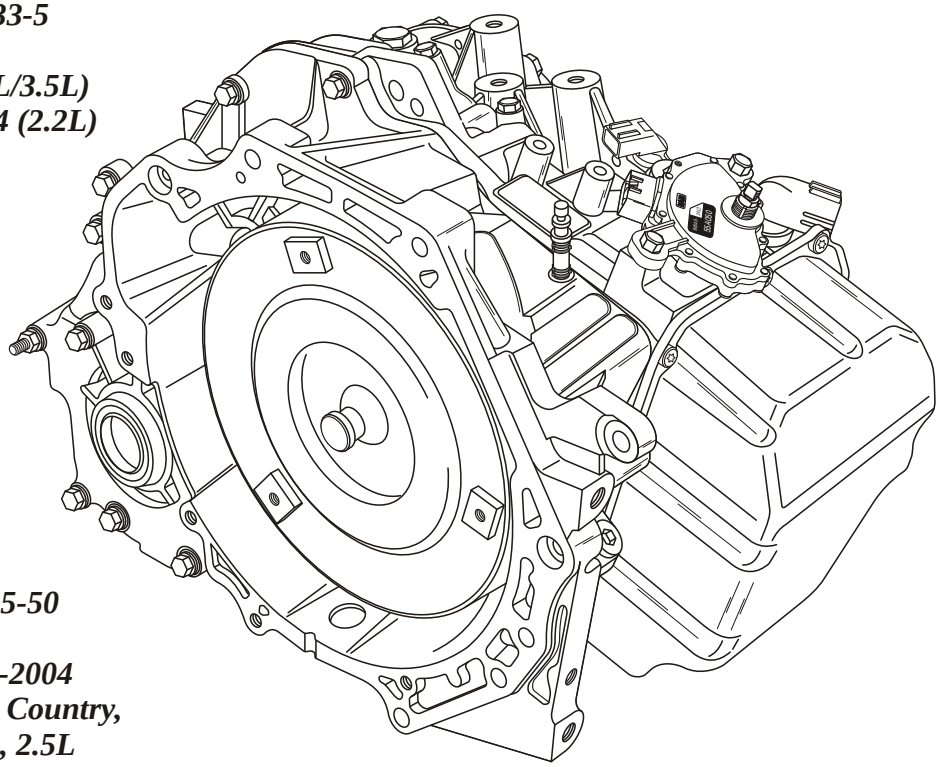
The three planetary gear sets provide the five forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module (TCM). The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids, within the transaxle, on and off to control shift timing. The TCM controls line pressure to maintain proper shift feel and clutch apply pressure. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance.

A Component Application chart and solenoid application chart have been provided for you in Figure 3.

Continued on next Page

G.M. Designation AF23/33-5
Found In:
Saturn Vue, 2002-2004 (3.0L/3.5L)
Saturn Ion Sedan, 2003-2004 (2.2L)



Volvo Designation AW 55-50
Found In:
Some Volvo Models 2000-2004
60, 70, 80 & 90 Series, Cross Country,
Equipped with 2.3L, 2.4L, 2.5L

Figure 1

GENERAL DESCRIPTION (Cont'd)

The hydraulic system primarily consists of a gear type pump, four control valve bodies, case cover, converter housing and case. The pump maintains the working pressures needed to stroke the servo and clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transaxle.

The friction components used in this transaxle consist of seven multiple disc clutches and one band. The multiple disc clutches combine with two mechanical sprag clutches, to deliver five forward gear ratios and reverse, through the gear sets. The gear sets then transfer torque through the front differential assembly and out to the drive axles.

GEAR RANGE DESCRIPTION

The transaxle can be operated in any one of the six different positions on the shift quadrant, that is shown in Figure 2.

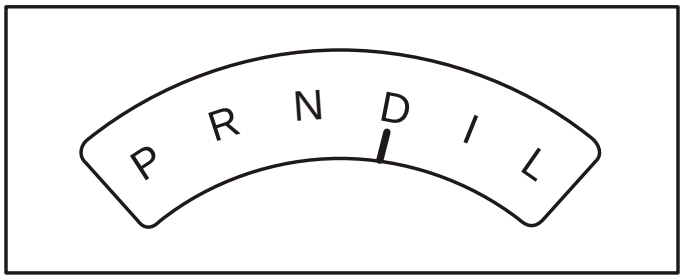


Figure 2

P - Park position enables the engine to be started while preventing the vehicle from rolling either forward or backward. For safety reasons the vehicle's parking brake should be used in addition to the "Park" position. Since the front differential assembly and drive axles are mechanically locked to the case through the parking pawl, Park position should not be selected until the vehicle has come to a complete stop.

R - Reverse position enables the vehicle to be operated in a rearward direction.

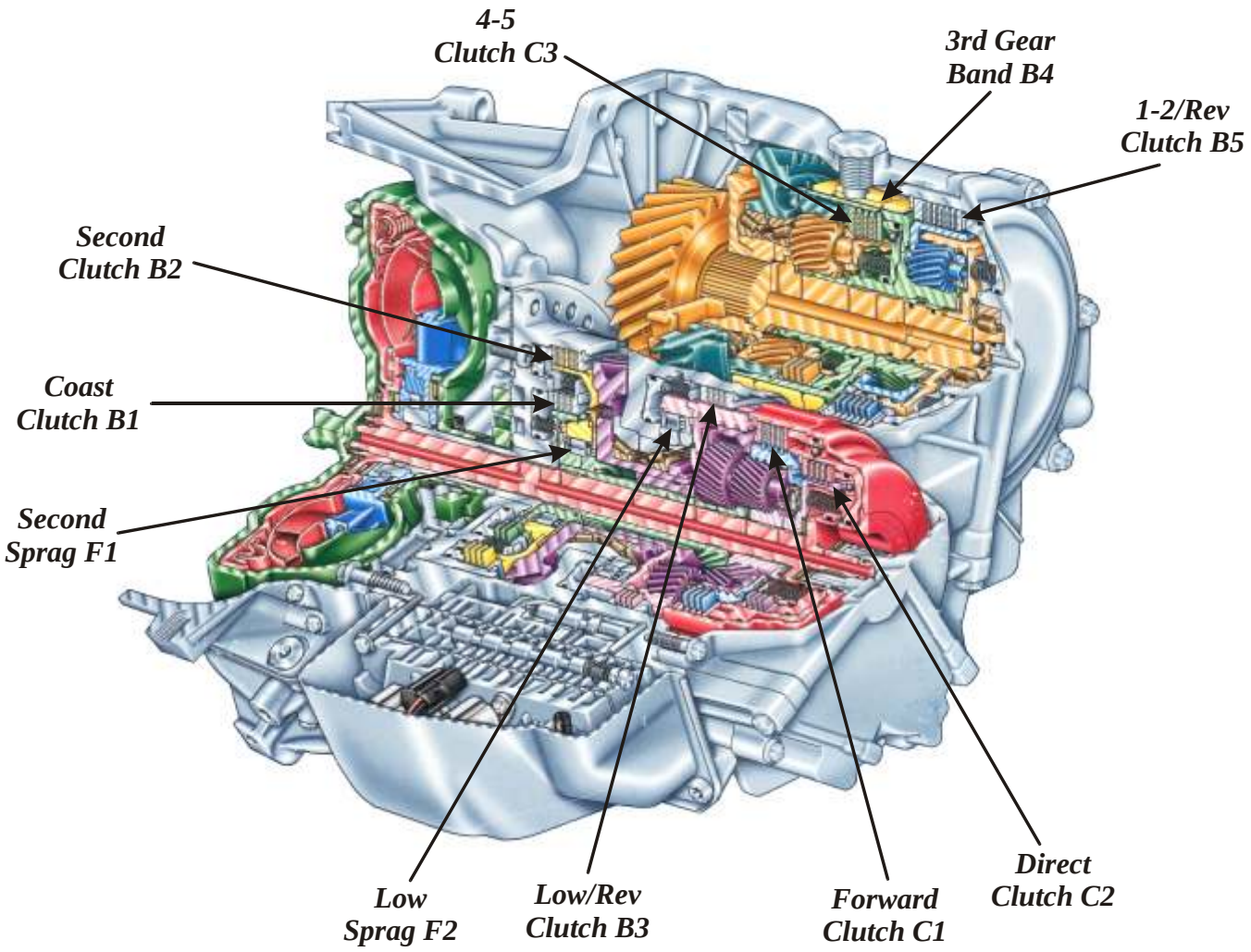
N - Neutral position enables the engine to start and operate without driving the vehicle. If necessary, this position should be selected to restart the engine while the vehicle is moving.

D - Drive position should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to operate in each of the five forward gear ratios. Downshifts to a lower gear ratio are available for safe passing by depressing the accelerator or by manually selecting a lower gear range with the selector lever.

I - Intermediate range can be used for conditions where it may be desirable to use only three gear ratios. These conditions include towing a trailer and driving on hilly terrain. This range is also helpful for engine braking when descending slight grades. Upshifts and downshifts are the same as in Drive range for 1st, 2nd, and 3rd gears except that the transmission is prevented from shifting above third gear. Intermediate range can be selected at any vehicle speed but will downshift into third gear only if vehicle speed is low enough to prevent engine overspeed.

L - Low range adds more performance for congested traffic and hilly terrain. It has the same starting ratio as 1st gear in Drive or Intermediate ranges but prevents the transmission from shifting above 2nd gear. Thus, Low can be used to retain 2nd gear for acceleration and engine braking as desired. Low range can be selected at any vehicle speed but will downshift into second gear only if vehicle speed is low enough to prevent engine overspeed. Low range is particularly beneficial for maintaining maximum engine braking when descending steep grades.

COMPONENT APPLICATION AND SOLENOID CHART



RANGE	GEAR	RATIO	SOL S1	SOL S2	SOL S3	SOL S4	SOL S5	SECOND CLUTCH (B2)	COAST CLUTCH (B1)	SECOND SPRAG (F1)	LOW SPRAG (F2)	LO/REV CLUTCH (B3)	FWD CLUTCH (C1)	DIRECT CLUTCH (C2)	4-5 CLUTCH (C3)	3RD BAND (B4)	1-2/REV CLUTCH (B5)
PARK	P		OFF	OFF	OFF	OFF	OFF										APPLIED
REVERSE	R	3.18	Off*	OFF	On*	OFF	On*					APPLIED		APPLIED			APPLIED
NEUTRAL	N		OFF	OFF	OFF	OFF	OFF										APPLIED
DRIVE	1	4.68	ON	OFF	ON	OFF	OFF				HOLD		APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED
	3	1.92	OFF	ON	ON	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED			APPLIED	
	4	1.30	OFF	ON	OFF	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED		APPLIED		
	5	1.00	OFF	OFF	OFF	ON	OFF	APPLIED					APPLIED	APPLIED	APPLIED		
	LIMP	1.00	OFF	OFF	OFF	OFF	OFF	APPLIED					APPLIED	APPLIED	APPLIED		
INTERM	1	4.68	ON	OFF	ON	OFF	OFF				HOLD		APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED
	3	1.92	OFF	ON	ON	ON	OFF	APPLIED	APPLIED	HOLD			APPLIED			APPLIED	
LOW	1 E/B	4.68	ON	OFF	ON	OFF	ON				HOLD	APPLIED	APPLIED				APPLIED
	2	2.94	OFF	ON	ON	OFF	OFF	APPLIED	APPLIED	HOLD			APPLIED				APPLIED

* If vehicle speed is above 7km/h (4 mph), the TCM commands the shift solenoids to inhibit reverse

Figure 3

ELECTRICAL COMPONENTS

Park/Neutral Position Switch Assembly

The Park/Neutral Position Switch assembly is a sliding contact switch attached to the manual shift detent lever assembly on the outside of transaxle, as shown in Figure 4. The four inputs to the TCM from the P/N switch indicate which position has been selected by the manual selector lever. This information is used for engine controls as well as determining the transaxle shift patterns. The state of each input is available for display on the scan tool. The four input parameters shown in Figure 5 are Mode A, Mode B, Mode C and Mode PA.

The Park/Neutral Position Switch assembly is also responsible for allowing the engine to be started in Park or Neutral only, and no other selector position. This switch is also responsible for illuminating the Back-Up lamps when Reverse is selected, as shown in Figure 5.

If the TCM detects an improper signal from the Park/Neutral Position Switch assembly, a DTC will be activated.

The DTC strategy may be different between the models you are working on i.e. Saturn or Volvo. All references in this information is for Saturn.

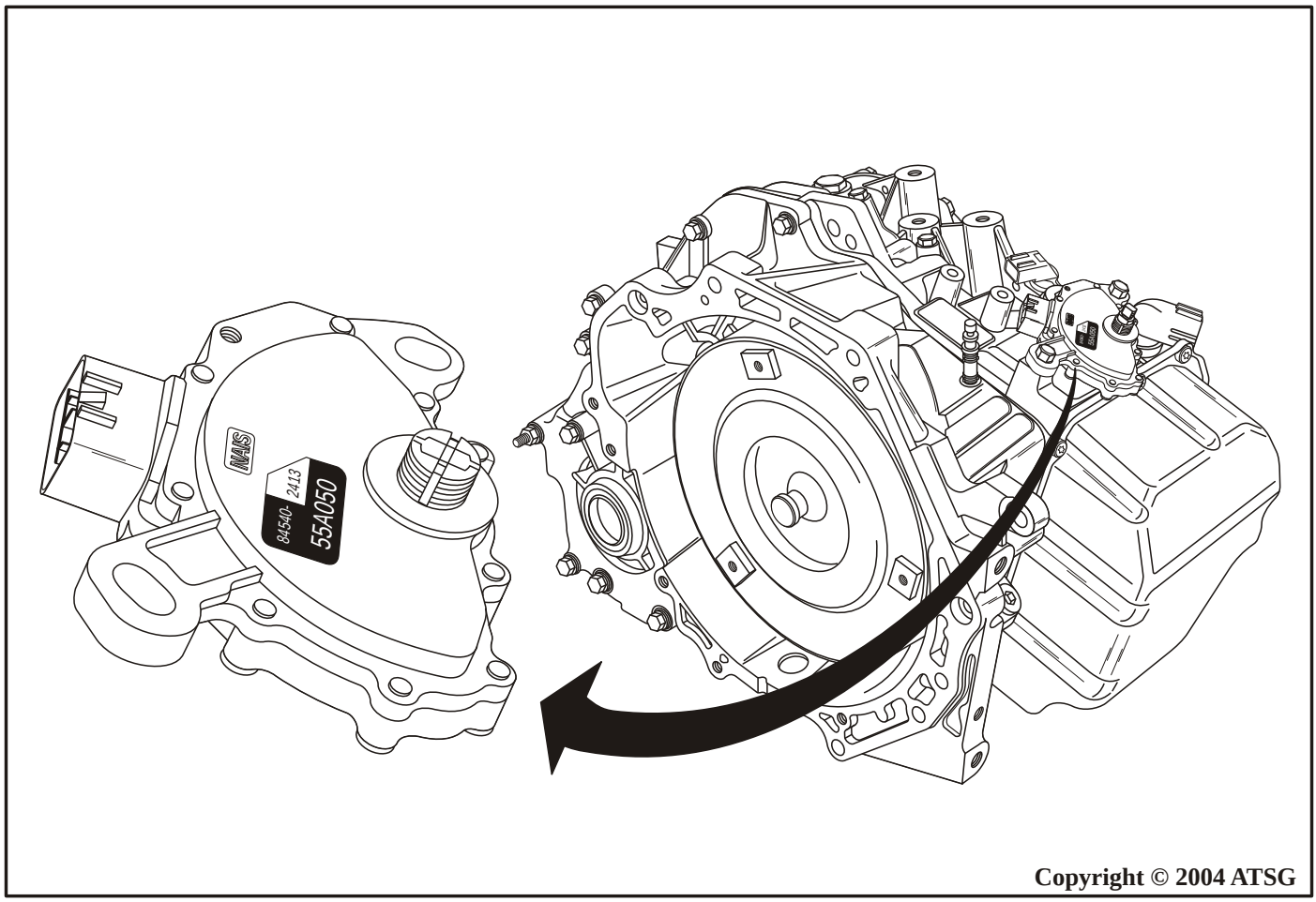
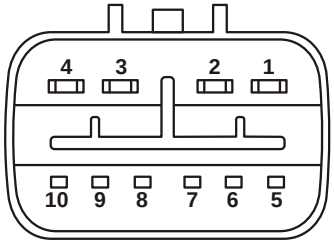


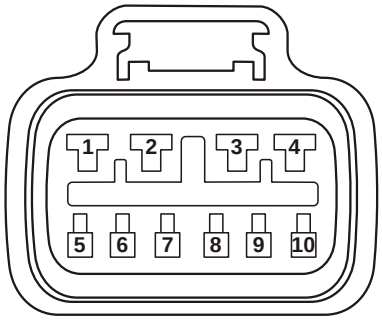
Figure 4

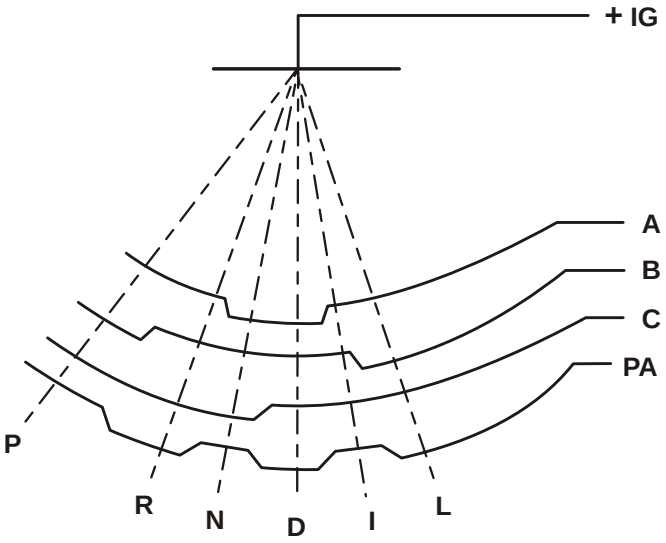
TRANSAXLE RANGE SWITCH 10-WAY CONNECTOR IDENTIFICATION			
Pin No.	*Wire Color*	*Circuit Number*	*Circuit Function*
1	*Pink*	*239*	*Back-Up Lamp Power Fuse (10A) From Underhood Fuse Block .*
2	*Lt. Green*	*24*	*Out To Back-Up Lamps.*
3	*Purple*	*6*	*Out To Starter Relay.*
4	*Yellow*	*5*	*Starter Relay Power Fuse (30A) From Underhood Fuse Block.*
5	*Gray*	*773*	*Transaxle Range "C" Signal To TCM.*
6	*Yellow*	*772*	*Transaxle Range "B" Signal To TCM.*
7	*Not Used*		
8	*White*	*776*	*Transaxle Range "P" Signal To TCM.*
9	*Pink*	*239*	*Range Switch Power Fuse (10A) From Underhood Fuse Block.*
10	*Tan/White*	*771*	*Transaxle Range "A" Signal To TCM.*

Transaxle Range Switch Connector, Face View



Transaxle Range Switch Vehicle Harness Connector, Face View





RANGE INDICATOR	CIRCUIT				
	+ IG	A	B	C	PA
Park	+	1	0	0	1
Reverse	+	1	1	0	0
Neutral	+	0	1	0	1
Drive	+	0	1	1	0
Intermediate	+	1	1	1	1
Low	+	1	0	1	0

1 = Closed (Resistance < 10 ohms)
2 = Open (Resistance > 100k ohms)

Figure 5

ELECTRICAL COMPONENTS (Cont'd)

Shift Solenoids

The AF23/33-5 uses five electromagnetic shift solenoids to control upshifts and down shifts in all forward ranges and are controlled by the TCM. They work together in a combination of ON and OFF sequences to control the various shift valves.

Reverse, 1st Shift Solenoid (SS1)

The reverse, 1st shift solenoid is a normally-open (N.O.), ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S1 signal fluid circuit through orifice No. 3. When the reverse, 1st shift solenoid is energized (ON), S1 fluid is blocked from exhausting through the solenoid, creating S1 fluid pressure that acts on the U1 shift valve and the M1 shift valve. When the reverse, 1st shift solenoid is OFF, any existing S1 signal fluid pressure is exhausted through holes at the base of the solenoid, as shown in Figure 6.

2-3, 3-4 Shift Solenoid (SS2)

The 2-3, 3-4 shift solenoid is a normally-open (N.O.) ON/OFF type solenoid controlled by the TCM. Drive fluid feeds the S2 signal fluid through orifice No. 25. When the 2-3, 3-4 shift solenoid is energized (ON), S2 fluid is blocked from exhausting through the solenoid, creating S2 signal fluid pressure that acts on the M2 shift valve, against spring force, to move the valve into the applied position. When the 2-3, 3-4 shift solenoid is OFF, any existing S2 signal fluid pressure is exhausted through the end of the solenoid, as shown in Figure 6.

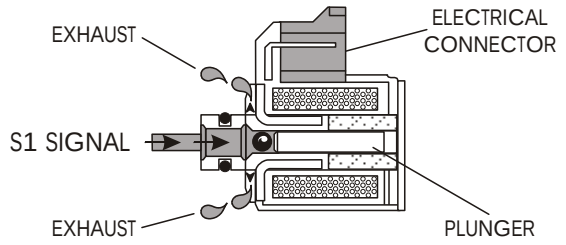
1-2, 2-3, Reverse Shift Solenoid (SS3)

The 1-2, 2-3, reverse shift solenoid is a normally-closed (N.C.) ON/OFF type solenoid controlled by the TCM. Drive fluid feeds the S3 signal fluid through orifice No. 24. When the 1-2, 2-3, reverse shift solenoid is energized (ON), S3 signal fluid is allowed to exhaust through the base of the solenoid, as shown in Figure 6. When the 1-2, 2-3, reverse shift solenoid is OFF, S3 signal fluid is blocked from exhausting through the base of the solenoid, creating S3 signal fluid pressure that acts on the U2 shift valve, against spring force, to move the valve into the applied position.

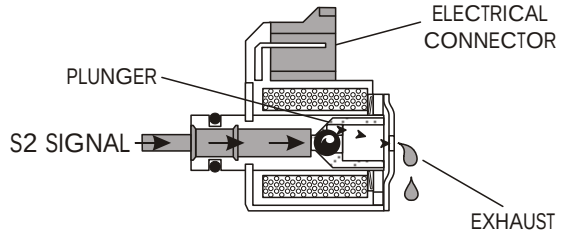
3-4, 4-5 Shift Solenoid (SS4)

The 3-4, 4-5 shift solenoid is a normally-open (N.O.) ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S4 signal fluid through orifice No. 4. When the 3-4, 4-5 shift solenoid is energized (ON), S4 fluid is blocked from exhausting through the solenoid, creating S4 signal fluid pressure that acts on the U2 shift valve and the U1 shift valve. When the 3-4, 4-5 shift solenoid is OFF, any existing S4 signal fluid pressure is exhausted through the end of the solenoid, as shown in Figure 6.

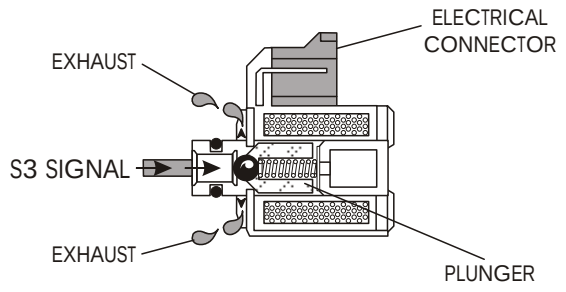
Reverse, 1st Shift Solenoid (SS1) "Normally Open"



2-3, 3-4 Shift Solenoid (SS2) "Normally Open"



1-2, 2-3, Reverse Shift Solenoid (SS3) "Normally Closed"



3-4, 4-5 Shift Solenoid (SS4) "Normally Open"

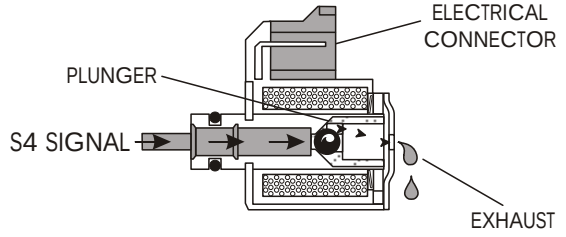


Figure 6

Worldwide

ELECTRICAL COMPONENTS (Cont'd)

Reverse Shift Solenoid (SS5)

The reverse shift solenoid is a normally-closed (N.C.) ON/OFF type solenoid controlled by the TCM. Line fluid feeds the S5 signal fluid through orifice No. 5. When the reverse shift solenoid is energized (ON), S5 signal fluid is allowed to exhaust through the base of the solenoid, as shown in Figure 7. When the reverse shift solenoid is OFF, S5 signal fluid is blocked from exhausting through the base of the solenoid, creating S5 signal fluid pressure that acts on the shift pressure relay valve, against spring force, to move the valve into the applied position.

Reverse Shift Solenoid (SS5) "Normally Closed"

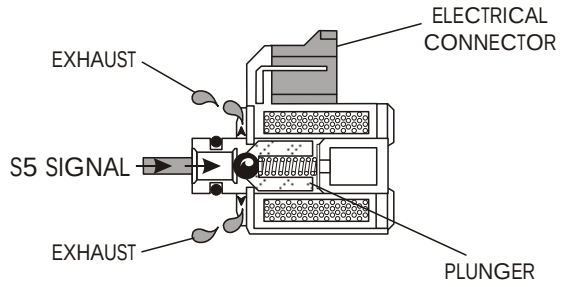


Figure 7

Line Pressure Control Solenoid (SLT)

The line pressure control solenoid is a normally-open 3-port solenoid and is a precision electronic pressure regulator that controls transaxle line pressure based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As current flow is increased, the pressure control to throttle signal is decreased. As current flow is decreased, the pressure control to throttle signal is increased (See Figure 8).

If a total electronic failure is encountered, this solenoid will put line pressure to maximum pressure, and will set DTC P0962 or P0963 in the TCM memory.

Line Pressure Control Solenoid (SLT) "Normally Open"

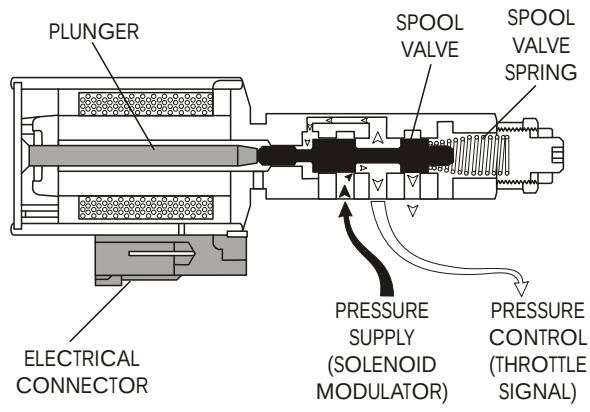


Figure 8

Transmission Adapt Function

Programming within the TCM allows for automatic adjustments in pressure that are based on the changing characteristics of the internal transaxle components. As the apply components within the transaxle wear, the time to apply a clutch increases. In order to compensate for this wear, the TCM adjusts trim pressure by controlling the line pressure control solenoid in order to maintain the originally calibrated shift timing. This process is referred to as "Adaptive Learning" and is used to assure consistent shift feel and increase transaxle durability. The TCM monitors the ISS and OSS during commanded shifts to determine if a shift is occuring too fast (harsh) or too slow (soft) and adjusts the line pressure control solenoid signal to maintain a set shift feel.

ELECTRICAL COMPONENTS (Cont'd)

Shift Pressure Control Solenoid (SLS)

The shift pressure control solenoid is a normally-open 3-port solenoid and is a precision electronic pressure regulator that controls transaxle clutch apply pressure based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As current flow is increased, the pressure control to clutch apply is decreased. As current flow is decreased, the pressure control to clutch apply is increased (See Figure 9).

If a total electronic failure is encountered, this solenoid will put clutch apply pressure to maximum pressure, and will set DTC P0970 or P0971 in the TCM memory.

Shift Pressure Control Solenoid (SLS) "Normally Open"

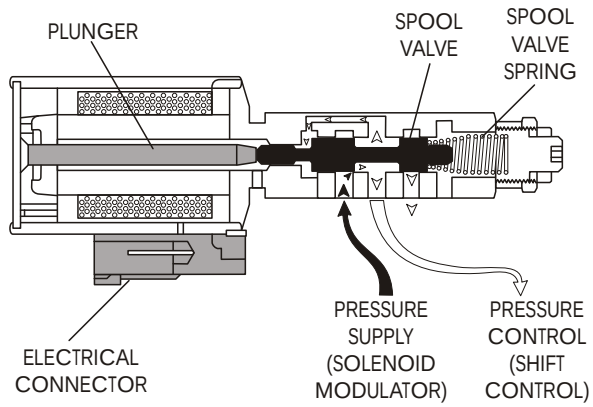


Figure 9

Transmission Adapt Function

Programming within the TCM allows for automatic adjustments in pressure that are based on the changing characteristics of the internal transaxle components. As the apply components within the transaxle wear, the time to apply a clutch increases. In order to compensate for this wear, the TCM adjusts trim pressure by controlling the shift pressure control solenoid in order to maintain the originally calibrated shift timing. This process is referred to as "Adaptive Learning" and is used to assure consistent shift feel and increase transaxle durability. The TCM monitors the ISS and OSS during commanded shifts to determine if a shift is occuring too fast (harsh) or too slow (soft) and adjusts the shift pressure control solenoid signal to maintain a set shift feel.

TCC Lock-Up Pressure Control Solenoid (SLU)

The TCC lock-up pressure control solenoid (SLU) is a normally-closed 3-port solenoid and is a precision electronic pressure regulator that controls the apply and release of the torque converter clutch, the second clutch (B2), and the Low/Reverse clutch (B3) during Low range, based on current flow through its coil windings. This solenoid is Pulse Width Modulated (PWM) and operates at a fixed frequency of 300 Hz (cycles per second) and from 0.0 to 1.1 amps. As the current flow is increased, the pressure control to TCC lock-up control pressure is increased. As current flow is decreased, the pressure control to TCC lock-up control pressure is decreased (See Figure 10).

If a total electronic failure is encountered, the torque converter clutch apply will be inhibited, and will set DTC P0966 or P0967 in the TCM memory.

TCC Pressure Control Solenoid (SLU) "Normally Closed"

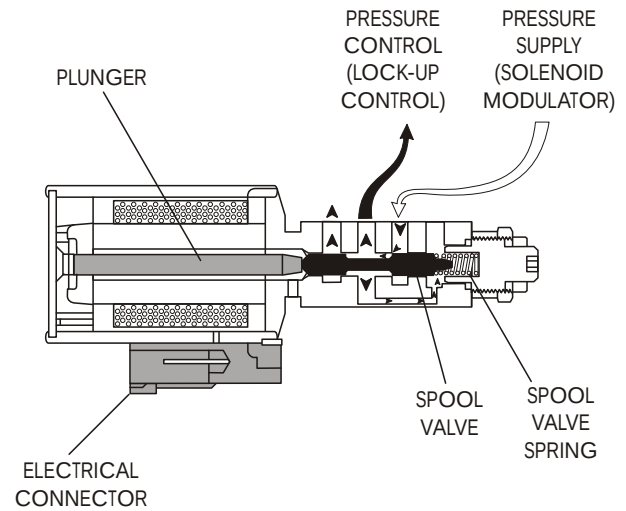


Figure 10

Lory

ELECTRICAL COMPONENTS (Cont'd)

Transmission Fluid Temp (TFT) Sensor

The TFT sensor is part of the transaxle internal wire harness assembly, as shown in Figure 12. The TFT sensor is a thermister, which changes value based on temperature, as shown in the chart in Figure 11.

The TCM supplies a 5 volt reference signal to the TFT sensor and measures the voltage drop in the circuit. When the transaxle fluid is cold, the TFT sensor resistance is high and the TCM detects high signal voltage. As the fluid temperature warms to a normal operating temperature, the resistance becomes less and the signal voltage decreases. The TCM uses this information to maintain shift quality and TCC apply quality over the entire operating temperature range.

If the TCM detects an improper signal from the TFT sensor, a DTC will be stored in TCM memory.

Temperature °C	*Ohms Resistance*
-40 °C	*77,480*
-30 °C	*44,000*
-20 °C	*25,880*
-10 °C	*15,730*
0 °C	*9,846*
10 °C	*6,445*
20 °C	*4,184*
30 °C	*2,829*
40 °C	*1,955*
50 °C	*1,379*
60 °C	*992*
70 °C	*726*
80 °C	*541*
90 °C	*409*
100 °C	*314*
110 °C	*247*
120 °C	*192*
130 °C	*153*
140 °C	*124*
150 °C	*101*

Figure 11

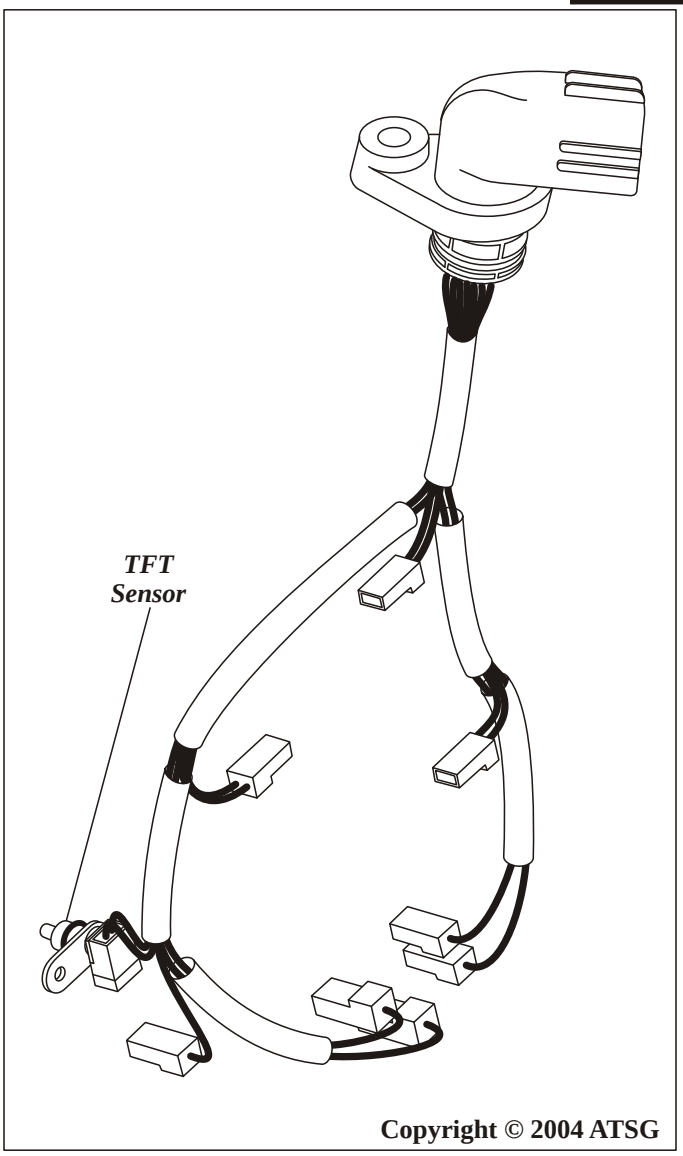


Figure 12

ELECTRICAL COMPONENTS (Cont'd)

Output Shaft Speed (OSS) Sensor

The Output Shaft Speed (OSS) sensor is an active, hall effect pickup located in the top of the transaxle case, as shown in Figure 13. This sensor is mounted in the case opposite the parking gear that is splined to the front differential transfer drive gear carrier assembly shaft. The sensor is supplied with a reference voltage of 0.6 volts. As the parking gear is rotated, a square wave voltage signal is generated by the teeth on the parking gear as they pass by the sensor, that is proportional to vehicle speed.

If the TCM detects an improper signal from the OSS, a DTC will be stored in the TCM memory.

Input Shaft Speed (ISS) Sensor

The Input Shaft Speed (ISS) sensor operates identically to the OSS sensor, except that it uses the teeth on the forward/direct clutch housing as the reluctor or rotor. The forward/direct clutch housing is driven at converter turbine speed. The TCM uses transaxle input and output speeds to help determine line pressure, transaxle shift patterns, TCC apply pressure, gear ratios, and TCC slippage for diagnostic purposes.

If the TCM detects an improper signal from the ISS, a DTC will be stored in the TCM memory.

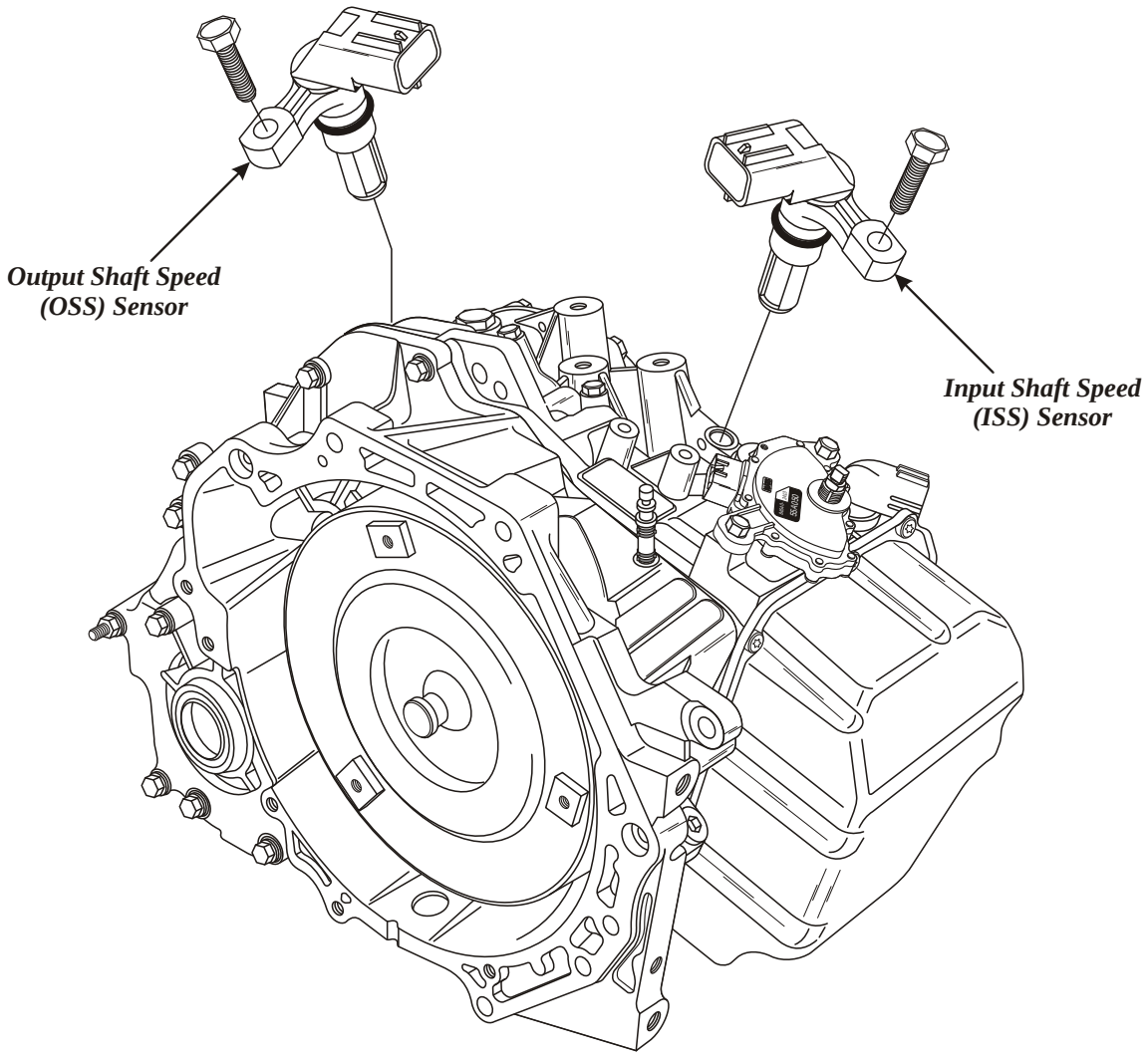


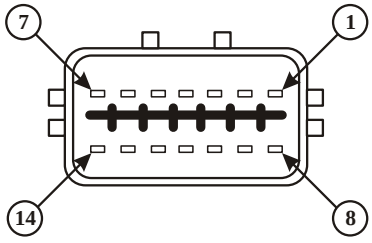
Figure 13

ELECTRICAL COMPONENTS (Cont'd)

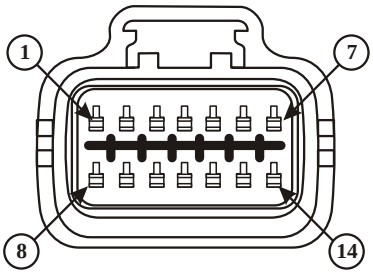
Transaxle CaseConnector Identification

The 14-way transaxle case connector is actually part of the internal wiring harness assembly, as shown in Figure 12. We have provided you with a chart in Figure 14 that identifies the individual terminals in the 14-way transaxle case connector and the vehicle external harness connector, color of the wires and circuit function. A complete transaxle wire schematic from transaxle to the TCM is provided in Figure 15, and a resistance chart for internal transaxle electrical components is shown in Figure 16.

TRANSAXLE CASE 14-WAY CONNECTOR IDENTIFICATION			
Pin No.	***Wire Color***	***Circuit Number***	***Circuit Function***
1	*Orange/Black*	*586*	*Transaxle Fluid Temp (TFT) Lo signal to TCM.*
2	*Red/White*	*981*	*Shift Pressure Control Solenoid (SLS) ground signal from TCM.*
3	*Lt. Green*	*977*	*TCC Control Solenoid (SLU) ground signal from TCM.*
4	*Black/White*	*979*	*Line Pressure Control Solenoid (SLT) ground signal from TCM.*
5	*Not Used*		
6	*Lt. Blue*	*974*	*Shift Solenoid 4 (S4) voltage signal from TCM.*
7	*Brown*	*972*	*Shift Solenoid 2 (S2) voltage signal from TCM.*
8	*Tan/White*	*585*	*Transaxle Fluid Temp (TFT) Hi signal to TCM.*
9	*Pink/White*	*980*	*Shift Pressure Control Solenoid (SLS) voltage signal from TCM.*
10	*Dk. Blue*	*976*	*TCC Control Solenoid (SLU) voltage signal from TCM.*
11	*Orange/White*	*978*	*Line Pressure Control Solenoid (SLT) voltage signal from TCM.*
12	*Purple*	*975*	*Shift Solenoid 5 (S5) voltage signal from TCM.*
13	*Red*	*973*	*Shift Solenoid 3 (S3) voltage signal from TCM.*
14	*Purple/White*	*971*	*Shift Solenoid 1 (S1) voltage signal from TCM.*



Transaxle Case Connector (Face View)



Vehicle Harness Connector (Face View)

Figure 14

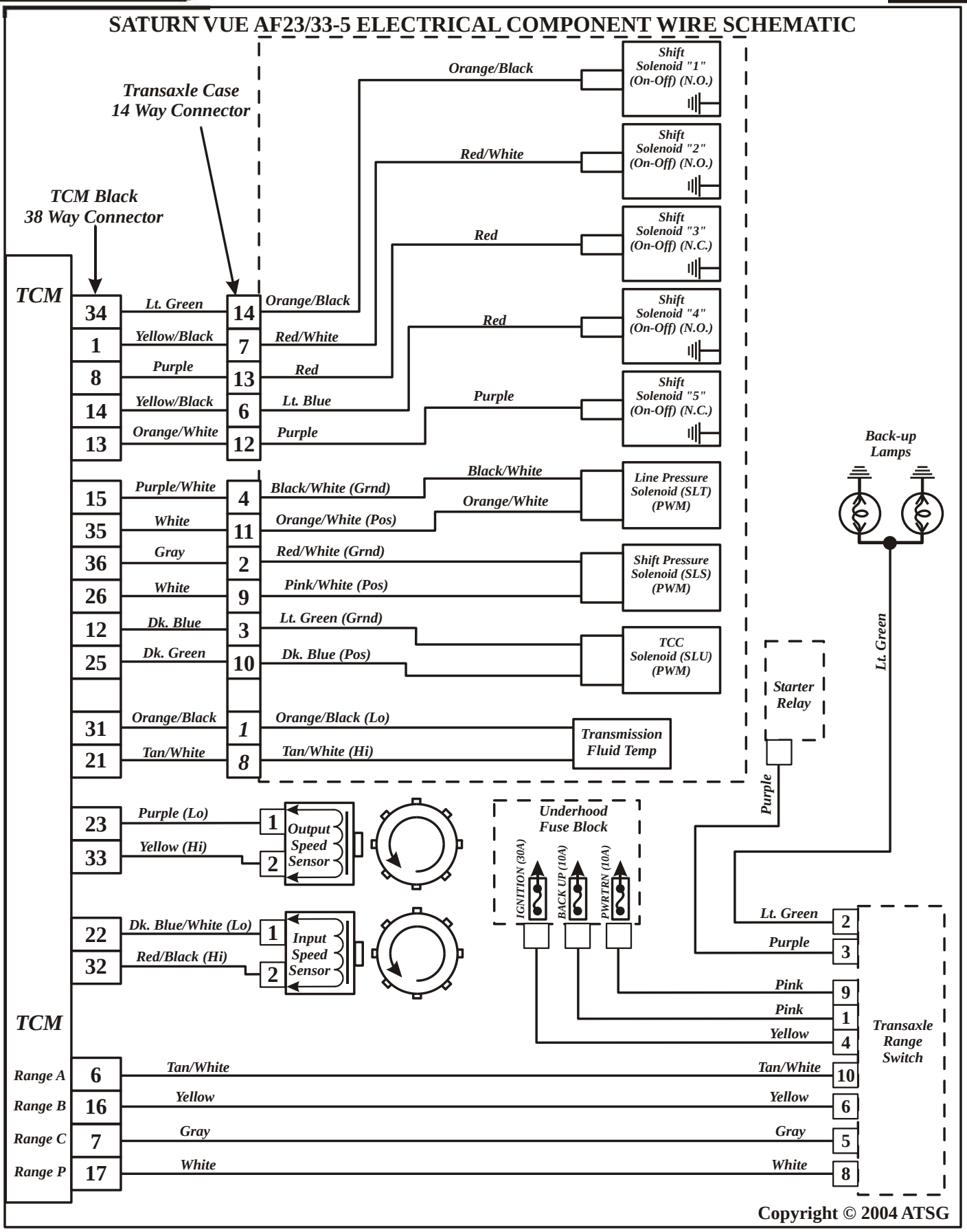

SATURN VUE AF23/33-5 ELECTRICAL COMPONENT WIRE SCHEMATIC
Transaxle Case
14 Way Connector
TCM Black
38 Way Connector
TCM
34 Lt. Green 14 Orange/Black
1 Yellow/Black 7 Red/White
8 Purple 13 Red
14 Yellow/Black 6 Lt. Blue
13 Orange/White 12 Purple
15 Purple/White 4 Black/White (Grnd)
35 White 11 Orange/White (Pos)
36 Gray 2 Red/White (Grnd)
26 White 9 Pink/White (Pos)
12 Dk. Blue 3 Lt. Green (Grnd)
25 Dk. Green 10 Dk. Blue (Pos)
31 Orange/Black 1 Orange/Black (Lo)
21 Tan/White 8 Tan/White (Hi)
Shift Solenoid "1" (On-Off) (N.O.)
Shift Solenoid "2" (On-Off) (N.O.)
Shift Solenoid "3" (On-Off) (N.C.)
Shift Solenoid "4" (On-Off) (N.O.)
Shift Solenoid "5" (On-Off) (N.C.)
Line Pressure Solenoid (SLT) (PWM)
Shift Pressure Solenoid (SLS) (PWM)
TCC Solenoid (SLU) (PWM)
Transmission Fluid Temp
Orange/Black
Red/White
Red
Red
Purple
Black/White
Orange/White
Back-up Lamps
Lt. Green
Starter Relay
Purple
23 Purple (Lo) 1
33 Yellow (Hi) 2
Output Speed Sensor
22 Dk. Blue/White (Lo) 1
32 Red/Black (Hi) 2
Input Speed Sensor
Underhood Fuse Block
IGNITION (30A)
BACK UP (10A)
PWRTRN (10A)
Lt. Green 2
Purple 3
Pink 9
Pink 1
Yellow 4
Transaxle Range Switch
TCM
Range A 6 Tan/White
Range B 16 Yellow
Range C 7 Gray
Range P 17 White
Tan/White 10
Yellow 6
Gray 5
White 8
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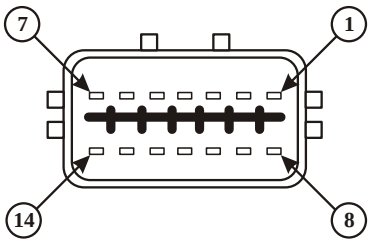
Figure 15

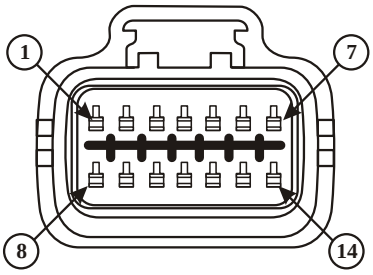
TRANSAXLE CASE 14-WAY CONNECTOR IDENTIFICATION		
Component	*Terminal Numbers*	*Ohms Resistance*
Shift Solenoid 1 (S1)	*14 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 2 (S2)	*7 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 3 (S3)	*13 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 4 (S4)	*6 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Shift Solenoid 5 (S5)	*12 and Grnd*	*11 - 16 Ohms @ 20° C (68° F)*
Line Pressure Control Solenoid (SLT)	*4 and 11*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
Shift Pressure Control Solenoid (SLS)	*2 and 9*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
TCC Control Solenoid (SLU)	*3 and 10*	*5.0 - 5.6 Ohms @ 20° C (68° F)*
Transaxle Fluid Temp (TFT)	*1 and 8*	*See Chart Below*
Input Shaft Speed (ISS) Sensor		*> 10 M Ohms @ 20° C (68° F)*
Output Shaft Speed (OSS) Sensor		*> 10 M Ohms @ 20° C (68° F)*

Transaxle Fluid Temp (TFT)

Temperature °C	*Ohms Resistance*
-40 °C	*77,480*
-30 °C	*44,000*
-20 °C	*25,880*
-10 °C	*15,730*
0 °C	*9,846*
10 °C	*6,445*
20 °C	*4,184*
30 °C	*2,829*
40 °C	*1,955*
50 °C	*1,379*
60 °C	*992*
70 °C	*726*
80 °C	*541*
90 °C	*409*
100 °C	*314*
110 °C	*247*
120 °C	*192*
130 °C	*153*
140 °C	*124*
150 °C	*101*



Transaxle Case Connector (Face View)



Vehicle Harness Connector (Face View)

Figure 16

EXTERNAL ELECTRONIC COMPONENTS

Throttle Position (TP) Sensor

The ECM monitors the variable voltage signal from the TP sensor to calculate throttle angle. These inputs are then sent over the CAN bus to the TCM, to determine the appropriate line pressure, shift pattern and TCC apply and release for the transaxle. In general with greater throttle angle, upshift speeds and line pressure will both increase.

Manifold Absolute Pressure (MAP) Sensor

The MAP sensor changes relative to intake manifold pressure which results from changes in engine load and speed. These changes are converted into a voltage signal which is monitored by the ECM and transmitted over the CAN bus to the TCM to assist in adjusting line pressure and shift timing.

Engine Coolant Temp (ECT) Sensor

The ECM monitors the variable resistance signal from this sensor to determine engine coolant temperature. When the engine is cold, resistance is high, and when the engine is hot, resistance through the sensor is low. The ECM then transmits this information over the CAN bus to the TCM where it is used to prevent TCC apply when the engine temp is below approximately 20°C (68°F).

Accelerator Pedal Position (APP) Sensor

The APP sensor is monitored by the ECM to determine accelerator pedal position and is transmitted over the CAN bus to the TCM, in order to help determine the appropriate line pressure, shift pattern and TCC apply and release speeds. In general with increased throttle position, upshift speeds and line pressure both increase.

TCC Brake Switch

This signal is transmitted over the CAN bus to the TCM and causes the TCM to command TCC release. When the brake pedal is depressed at low speeds, the TCM opens the ground path for the TCC electrical circuit which releases the converter clutch.

Controller Area Network (CAN) Bus

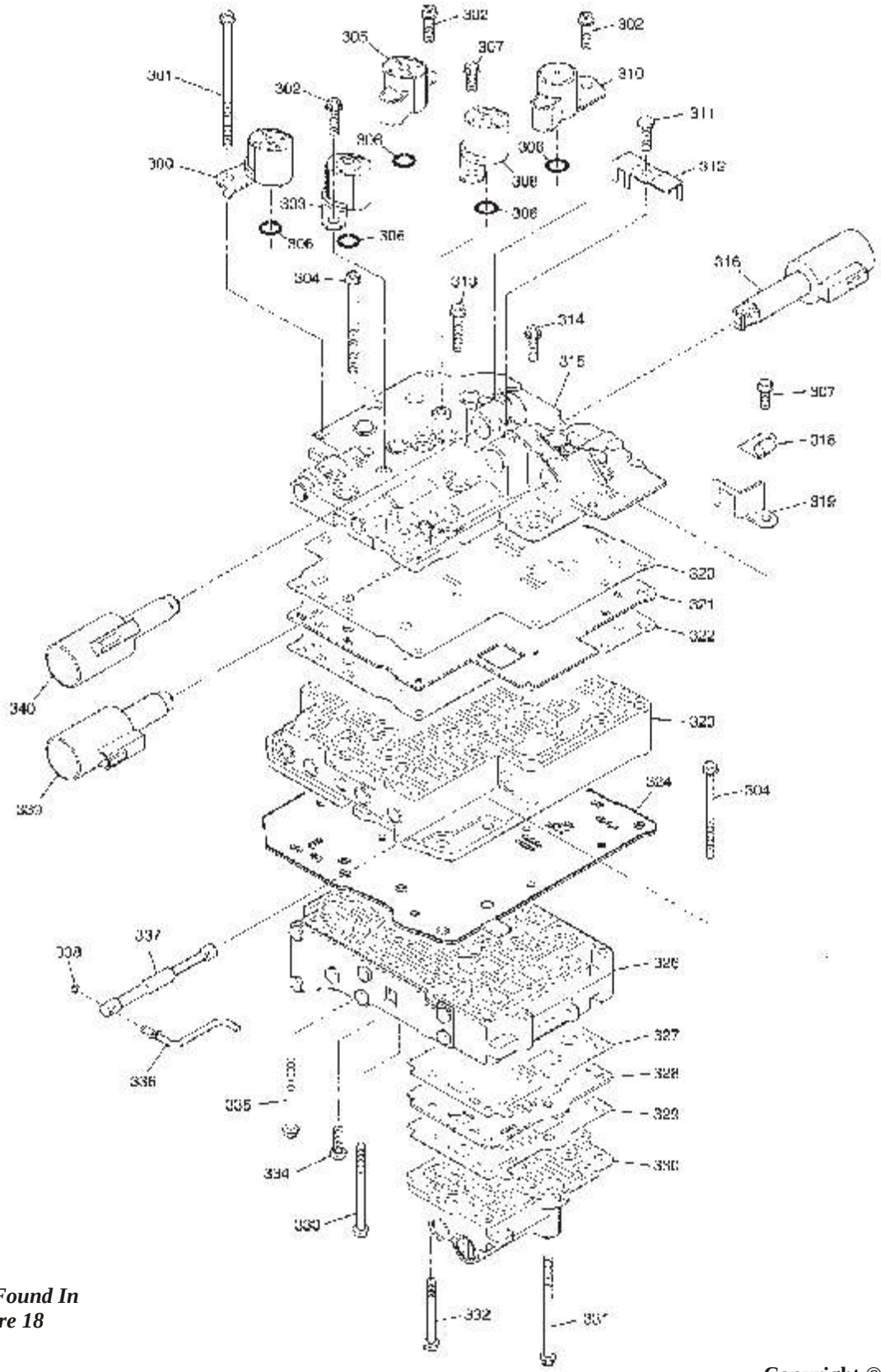
The CAN bus consists of two twisted wires that connect the various vehicle control modules together, allowing them to share information about vehicle conditions.

Note: The sensor/switch information listed above is not a complete listing of TCM inputs that may affect transaxle operation. The combination and usage of these inputs may vary depending on model and the application. Always refer to the appropriate service manual for specific electrical diagnosis information.

	SATURN VUE AF2333-5 DIAGNOSTIC TROUBLE CODES
CODE	***DESCRIPTION***
P0562	***System Voltage low (Battery)***
P0563	***System Voltage high (Battery)***
P0601	***TCM Read only memory failure (ROM)***
P0602	***TCM not programmed (no vin number loaded in TCM)***
P0603	***TCM long term memory failure (check-sum failure)***
P0604	***TCM random access failure (RAM)***
P0703	***Brake switch fault via ECM thru CAN***
P0705	***Transmission range switch fault***
P0711	***Transmission fluid temp sensor performance***
P0713	***Transmission fluid temp sensor circuit low voltage***
P0715	***Transmission fluid temp sensor circuit high voltage***
P0717	***Input speed sensor low voltage***
P0722	***Output speed sensor low voltage***
	Continued on next Page

SATURN VUE AF2333-5 DIAGNOSTIC TROUBLE CODES	
CODE	***DESCRIPTION***
P0727	***Engine RPM sensor fault via ECM thru CAN***
P0730	***Incorrect 1st gear Low ratio***
P0731	***Incorrect 1st gear ratio***
P0732	***Incorrect 2nd gear ratio***
P0733	***Incorrect 3rd gear ratio***
P0734	***Incorrect 4th gear ratio***
P0735	***Incorrect 5th gear ratio***
P0736	***Incorrect Reverse ratio***
P0741	***TCC stuck off***
P0744	***TCC intermittent system fault (Mechanical)***
P0762	***SS3 stuck open (Mechanical)***
P0962	***Line Pressure Control Solenoid Low current***
P0963	***Line Pressure Control Solenoid High current***
P0966	***TCC Pressure Control Solenoid Low current***
P0967	***TCC Pressure Control Solenoid High current***
P0970	***Shift Pressure Control Solenoid Low current***
P0971	***Shift Pressure Control Solenoid High current***
P0973	***SS1 Control Circuit Low voltage***
P0974	***SS1 Control Circuit High voltage***
P0976	***SS2 Control Circuit Low voltage***
P0977	***SS2 Control Circuit High voltage***
P0979	***SS3 Control Circuit Low voltage***
P0980	***SS3 Control Circuit High voltage***
P0982	***SS4 Control Circuit Low voltage***
P0983	***SS4 Control Circuit High voltage***
P0985	***SS5 Control Circuit Low voltage***
P0986	***SS5 Control Circuit High voltage***
P1719	***Incorrect shifting detected (Mechanical)***
P1779	***Invalid Torque Delivered Signal from ECM via CAN***
P1780	***Invalid Torque Reduction request from ECM via CAN***
P1781	***Invalid Engine Torque Signal Circuit from ECM via CAN***
P1791	***Invalid Pedal Position Signal Circuit from ECM via CAN***
P1792	***Invalid Engine Coolant Signal Circuit from ECM via CAN***
P1868	***Transmission fluid over 212°F or Calculated Fluid life at 0%***

COMPLETE VALVE BODY ASSEMBLY EXPLODED VIEW



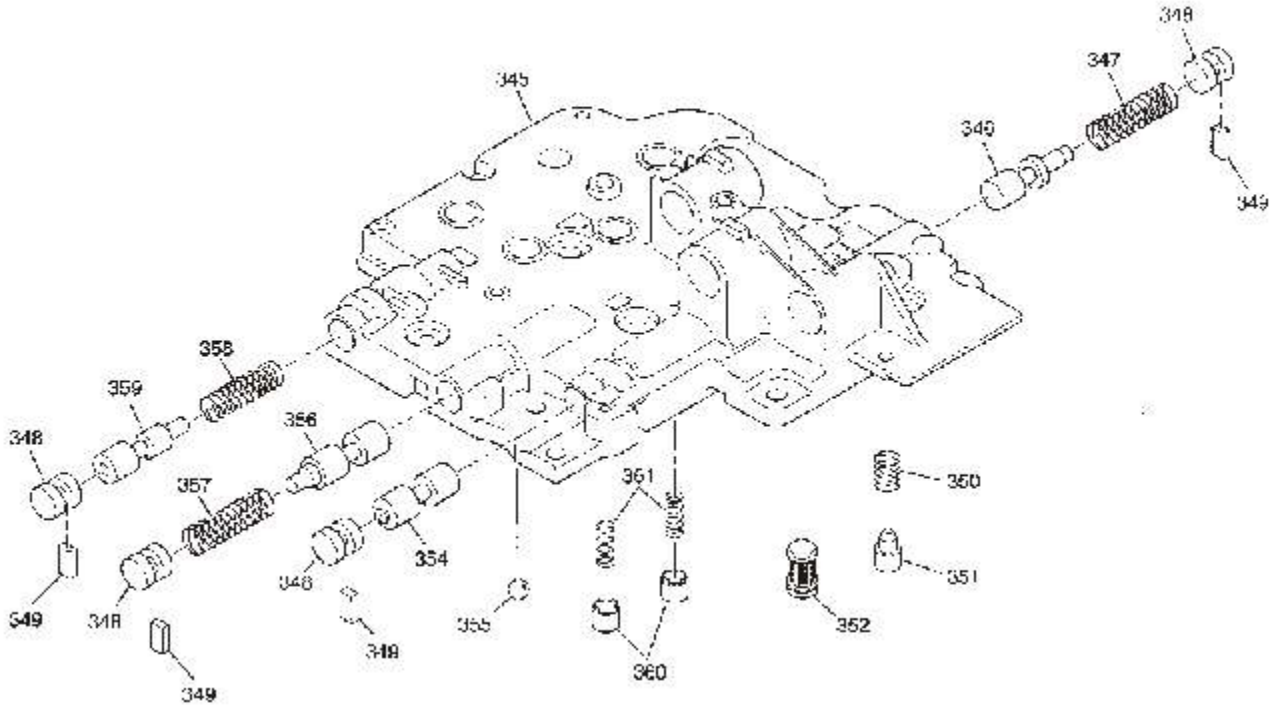
Legend Found In Figure 18

Figure 17

300 1-2, 2-3 REVERSE SHIFT SOLENOID (S3) - DARK GRAY
301 VALVE BODY BOLT, M5 X 0.8 X 62 (1)
302 VALVE BODY BOLT, M5 X 0.8 X 28 (3)
303 3-4, 4-5 SHIFT SOLENOID (S4) - BLUE
304 VALVE BODY BOLT, M5 X 0.8 X 50 (2)
305 REVERSE SHIFT SOLENOID (S5) - BROWN
306 SHIFT SOLENOID "O" RING SEAL (6)
307 VALVE BODY BOLT, M5 X 0.8 X 10 (2)
308 2-3, 3-4 SHIFT SOLENOID (S2) - BLACK
310 REVERSE, 1ST SHIFT SOLENOID (S1) - BLACK
311 VALVE BODY BOLT, M5 X 0.8 X 13 (1)
312 SOLENOID ASSEMBLY RETAINER
313 VALVE BODY BOLT, M5 X 0.8 X 20 (2)
314 VALVE BODY BOLT, M5 X 0.8 X 16 (2)
315 FRONT VALVE BODY ASSEMBLY
316 LINE PRESSURE CONTROL SOLENOID (SLT) - BLUE
318 WIRING HARNESS CLIP
319 TCC PRESSURE CONTROL SOLENOID (SLU) RETAINER
320 FRONT VALVE BODY TO FRONT SPACER PLATE GASKET
321 FRONT VALVE BODY SPACER PLATE
322 FRONT SPACER PLATE TO MIDDLE VALVE BODY GASKET
323 MIDDLE VALVE BODY ASSEMBLY
324 MIDDLE V.B. TO REAR V.B. SPACER PLATE/GASKET ASSEMBLY
326 REAR VALVE BODY ASSEMBLY
327 REAR V.B. TO SPACER PLATE GASKET
328 REAR V.B. TO REAR V.B. NO. 2 SPACER PLATE
329 REAR V.B. NO. 2 SPACER PLATE TO REAR V.B. NO. 2 GASKET
330 REAR VALVE BODY NO.2 ASSEMBLY
331 VALVE BODY BOLT, M5 X 0.8 X 76 (1)
332 VALVE BODY BOLT, M5 X 0.8 X 49.5 (4)
333 VALVE BODY BOLT, M5 X 0.8 X 40 (1)
334 VALVE BODY TEST HOLE PRESSURE TAP, M6 X 1.0 X 12 (1)
335 VALVE BODY BOLT, M5 X 0.8 X 35 (2)
336 MANUAL VALVE LINK
337 MANUAL VALVE
338 MANUAL VALVE LINK RETAINER
339 TCC PRESSURE CONTROL SOLENOID (SLU) - BLACK
340 SHIFT PRESSURE CONTROL SOLENOID (SLS) - GREEN

Figure 18

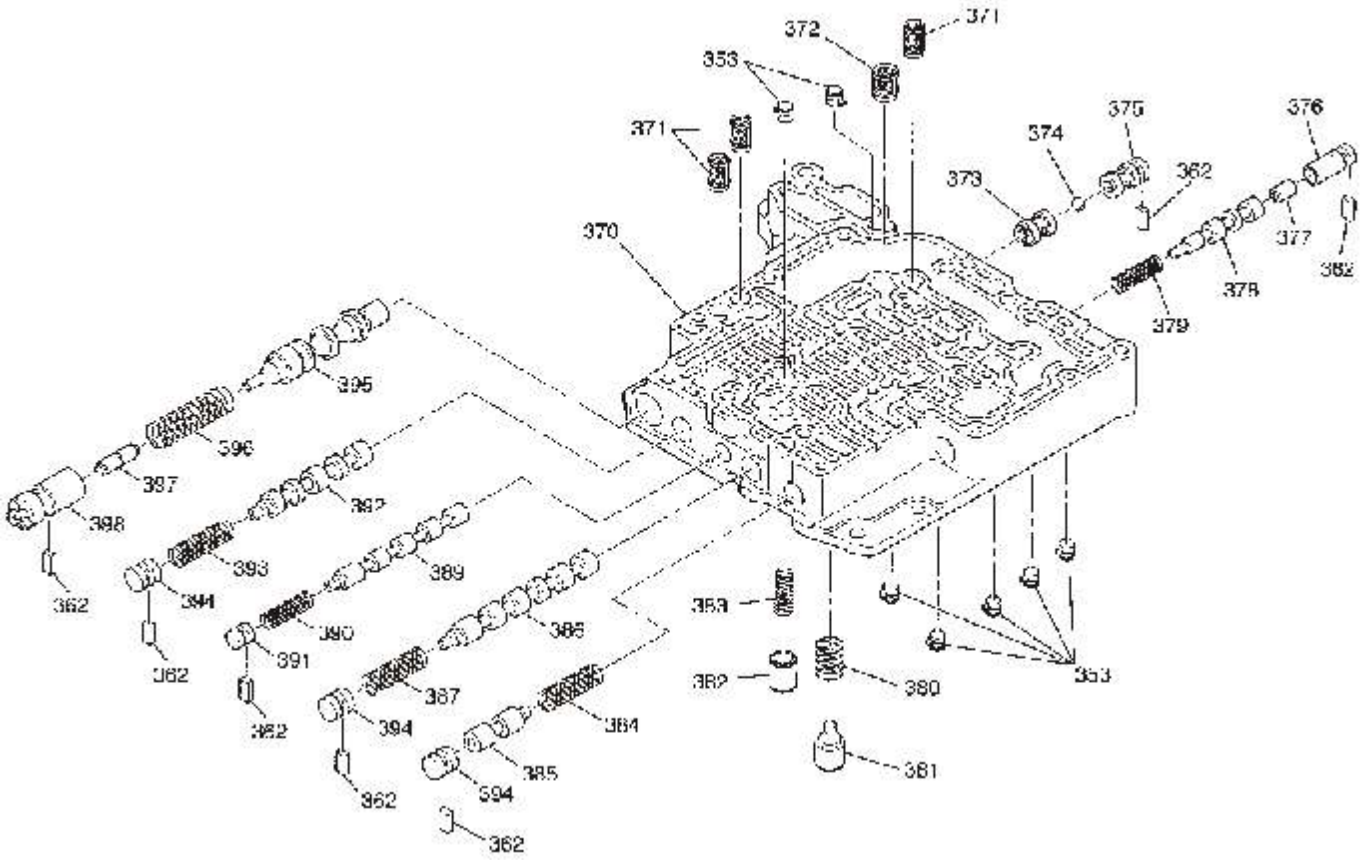
FRONT VALVE BODY EXPLODED VIEW



345 FRONT VALVE BODY CASTING
346 SOLENOID MODULATOR VALVE
347 SOLENOID MODULATOR VALVE SPRING (YELLOW)
348 SOLENOID MODULATOR VALVE BORE PLUG (4)
349 BORE PLUG RETAINER (3.2 X 5 X 10) (4)
350 PRESSURE RELIEF VALVE SPRING (NATURAL)
351 PRESSURE RELIEF VALVE
352 SCREEN
354 FORWARD CLUTCH (C1) CONTROL VALVE
355 CHECKBALL
356 NEUTRAL RELAY VALVE
357 NEUTRAL RELAY VALVE SPRING (LT. BLUE)
358 2ND COAST CLUTCH (B1) CONTROL VALVE SPRING (BLUE)
359 2ND COAST CLUTCH (B1) CONTROL VALVE
360 CHECK VALVE (2)
361 CHECK VALVE SPRING (2)

Figure 19

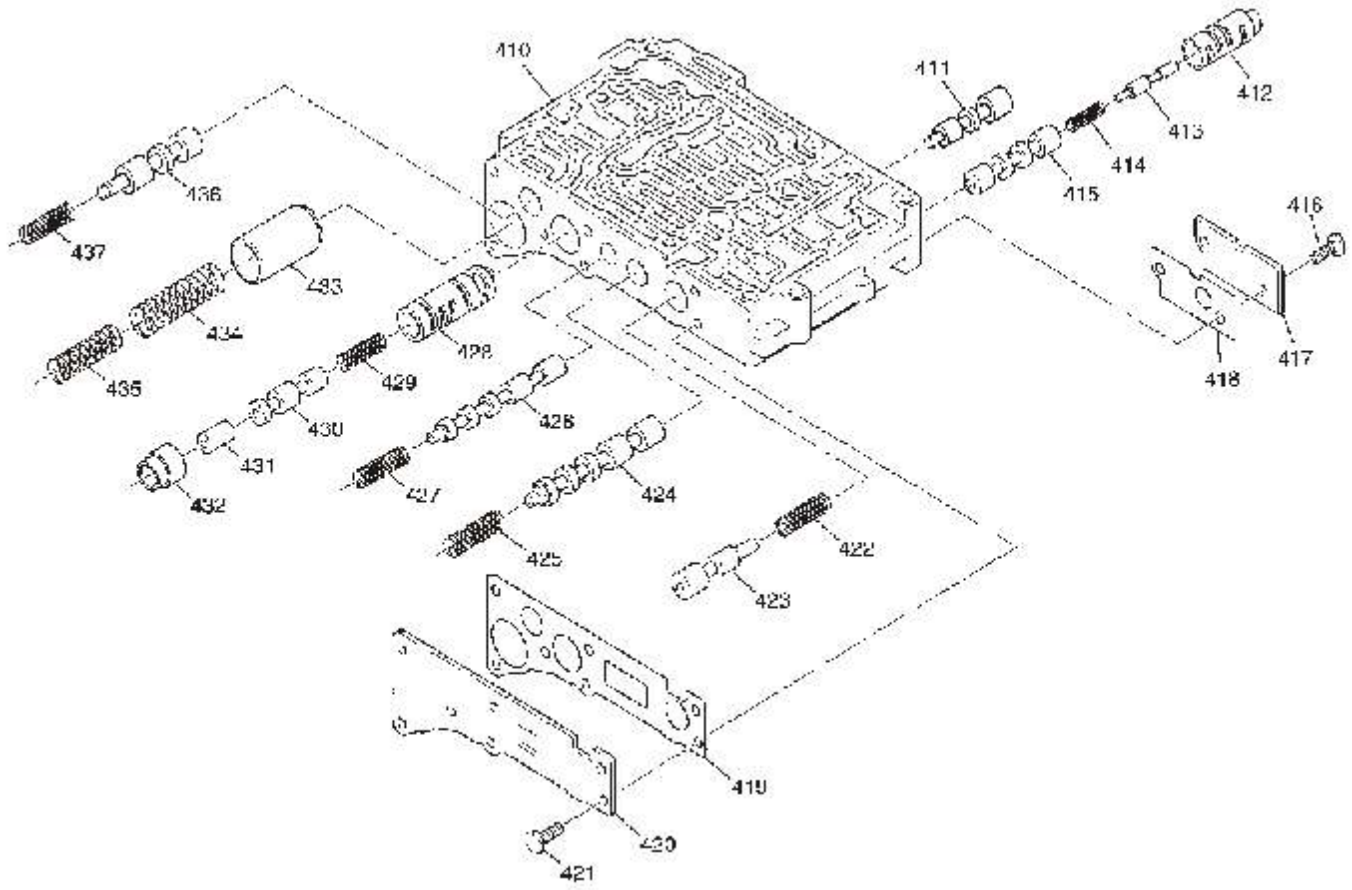
MIDDLE VALVE BODY EXPLODED VIEW



353 ACCUMULATOR CHECK VALVE ASSEMBLY (7)
362 BORE BLUG RETAINER (3.2 X 5 X 12.5) (7)
370 MIDDLE VALVE BODY CASTING
371 SCREEN (3)
372 SCREEN (1)
373 REVERSE SHIFT CHECKBALL "INNER" BUSHING
374 REVERSE SHIFT CHECKBALL
375 REVERSE SHIFT CHECKBALL "OUTER" BUSHING
376 SOLENOID RELAY VALVE BUSHING
377 SOLENOID RELAY VALVE PLUNGER
378 SOLENOID RELAY VALVE
379 SOLENOID RELAY VALVE SPRING (ORANGE)
380 COOLER BY-PASS VALVE SPRING (NATURAL)
381 COOLER BY-PASS VALVE
382 TCC CHECK VALVE
383 TCC CHECK VALVE SPRING (YELLOW)
384 3RD GEAR BAND (B4) RELEASE VALVE SPRING (BLUE)
385 3RD GEAR BAND (B4) RELEASE VALVE
386 U1 SHIFT VALVE
387 U1 SHIFT VALVE SPRING (LT. GREEN)
389 M1 SHIFT VALVE
390 M1 SHIFT VALVE SPRING (LT. BLUE)
391 M1 SHIFT VALVE BORE PLUG
392 U2 SHIFT VALVE
393 U2 SHIFT VALVE SPRING (LT. GREEN)
394 U2 SHIFT VALVE BORE PLUG (3)
395 PRIMARY PRESSURE REGULATOR VALVE
396 PRIMARY PRESSURE REGULATOR VALVE SPRING (PURPLE)
397 PRIMARY PRESSURE REGULATOR REVERSE BOOST VALVE
398 PRIMARY PRESSURE REGULATOR VALVE BUSHING

Figure 20

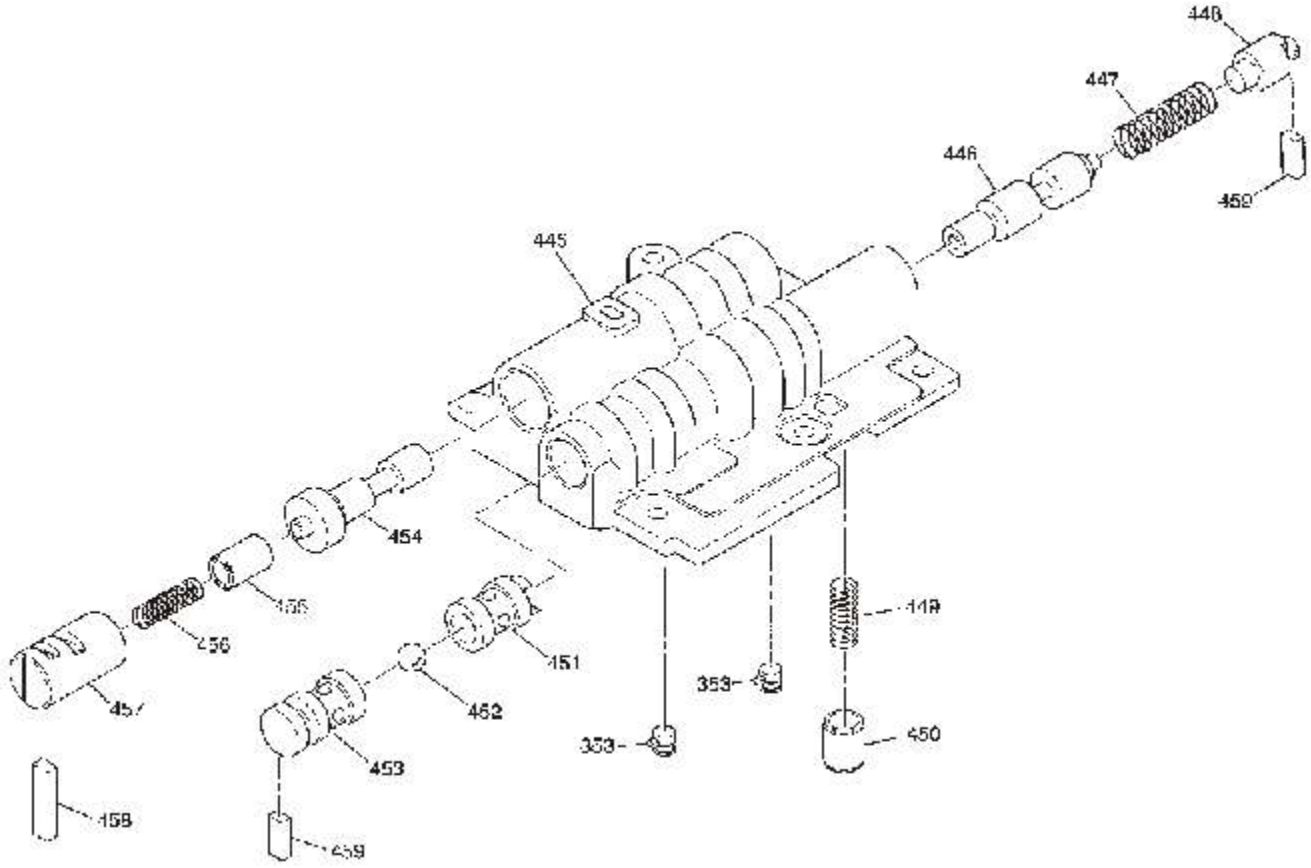
REAR VALVE BODY EXPLODED VIEW



410 REAR VALVE BODY CASTING
411 1-2, REVERSE CLUTCH (B5) CONTROL VALVE
412 LOCK-UP RELAY CONTROL VALVE BUSHING
413 LOCK-UP RELAY CONTROL VALVE PLUNGER
414 LOCK-UP RELAY CONTROL VALVE SPRING (RED)
415 LOCK-UP RELAY VALVE
416 SMALL COVER PLATE BOLT, M5 X 0.8 X 13 (2)
417 SMALL COVER PLATE
418 SMALL COVER PLATE GASKET
419 LARGE COVER PLATE GASKET
420 LARGE COVER PLATE
421 LARGE COVER PLATE BOLT, M5 X 0.8 X 13 (7)
422 3RD GEAR BAND (B4) CONTROL VALVE SPRING (ORANGE)
423 3RD GEAR BAND (B4) CONTROL VALVE
424 SHIFT PRESSURE RELAY VALVE
425 SHIFT PRESSURE RELAY VALVE SPRING (LT. GREEN)
426 M2 SHIFT VALVE
427 M2 SHIFT VALVE SPRING (LT. BLUE)
428 SHIFT PRESSURE CONTROL VALVE BUSHING
429 SHIFT PRESSURE CONTROL VALVE SPRING (WHITE)
430 SHIFT PRESSURE CONTROL VALVE
431 SHIFT PRESSURE CONTROL VALVE PLUNGER
432 SHIFT PRESSURE CONTROL VALVE PLUNGER SLEEVE
433 LINE PRESSURE CONTROL ACCUMULATOR PISTON
434 LINE PRESSURE ACCUMULATOR "OUTER" SPRING (ORANGE)
435 LINE PRESSURE ACCUMULATOR "INNER" SPRING (ORANGE)
436 SECONDARY REGULATOR VALVE
437 SECONDARY REGULATOR VALVE SPRING (NATURAL)

Figure 21

NUMBER 2 REAR VALVE BODY EXPLODED VIEW



353 ACCUMULATOR CHECK VALVE ASSEMBLY (2)
445 NUMBER 2 REAR VALVE BODY CASTING
446 2ND CLUTCH (B2) CONTROL VALVE
447 2ND CLUTCH (B2) CONTROL VALVE SPRING (NATURAL)
448 2ND CLUTCH (B2) CONTROL VALVE BORE PLUG
449 TCC CHECK VALVE SPRING (LT. BLUE)
450 TCC CHECK VALVE
451 REVERSE SHIFT INHIBIT CHECKBALL "INNER" BUSHING
452 REVERSE SHIFT INHIBIT CHECKBALL
453 REVERSE SHIFT INHIBIT CHECKBALL "OUTER" BUSHING
454 LOCK-UP CONTROL VALVE
455 LOCK-UP CONTROL VALVE PLUNGER
456 LOCK-UP CONTROL VALVE SPRING (YELLOW)
457 LOCK-UP CONTROL VALVE BUSHING
458 BORE PLUG RETAINER (3.2 X 5 X 21.2) (1)
459 BORE PLUG RETAINER (3.2 X 5 X 15) (2)

Figure 22

ZF5HP24 (A5S 440Z)

"E" CLUTCH PISTON FAILURE

COMPLAINT: The transmission exhibits flared 1-2 and 2-3 shifts. P0732 and P0733 "Gear Control Malfunction 2nd and 3rd" codes are stored. Disassembly and inspection of the transmission reveals that the "E" clutch piston is badly cracked (Refer to Figure 1).

CAUSE: This condition is primarily seen in the Audi A8 and Jaguar XK8/XJ8 models. At this time the cause is unclear, however, it may be non-commanded line pressure spikes.

CORRECTION: Replace the "E" clutch piston.

SERVICE INFORMATION:

"E" Clutch Piston.....1058-375-020

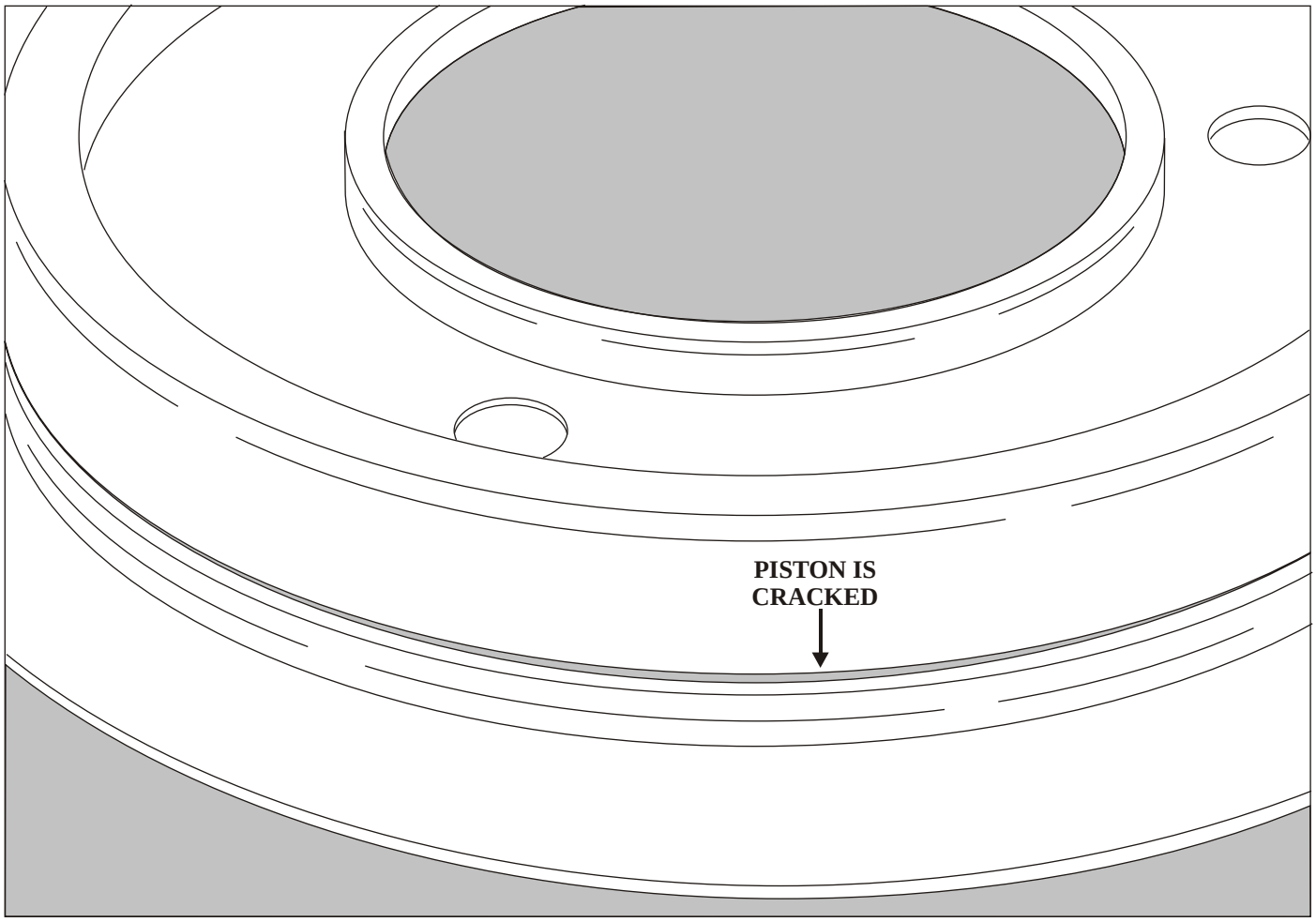


Figure 1

ZF INDUSTRIES

VALVE BODY RECONDITIONING KITS

ZF Industries has made available to the aftermarket, original equipment valve body reconditioning kits. These kits include new valve springs, orifice plugs, small parts, including checkballs and any other valve updates that have been made. Previously there were only two kits available for ZF5HP-19 and ZF5HP-30.

Refer to Figure 1 for a view of the ZF5HP-19 valve body, and Figure 2 for a view of the ZF5HP-24 valve body complete assembly.

ZF5HP-19 VALVE BODY RECONDITIONING KIT.....5HP19VBK
(***Note:*** The kit that is currently available is for BMW versions ***only***. The Audi kit will be available soon.)
ZF5HP-24 VALVE BODY RECONDITIONING KIT.....5HP24VBK
(***Note:*** This kit covers BMW, Jaguar and Rover applications.)

ZF5HP-19 VALVE BODY

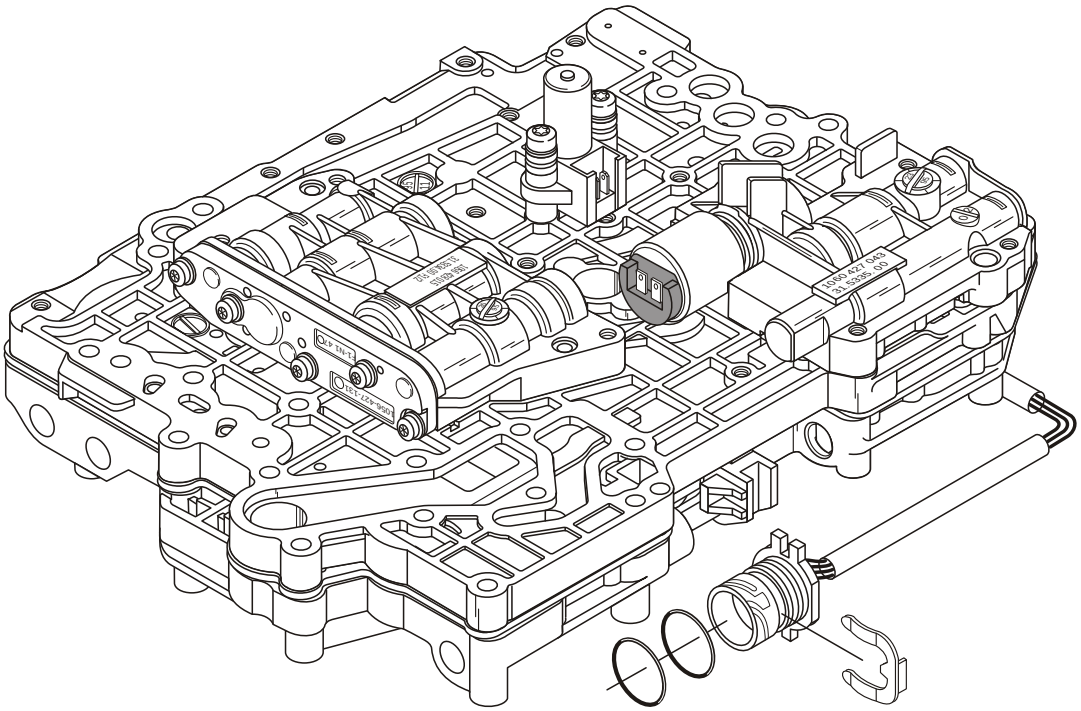


Figure 1

ZF5HP-24 VALVE BODY

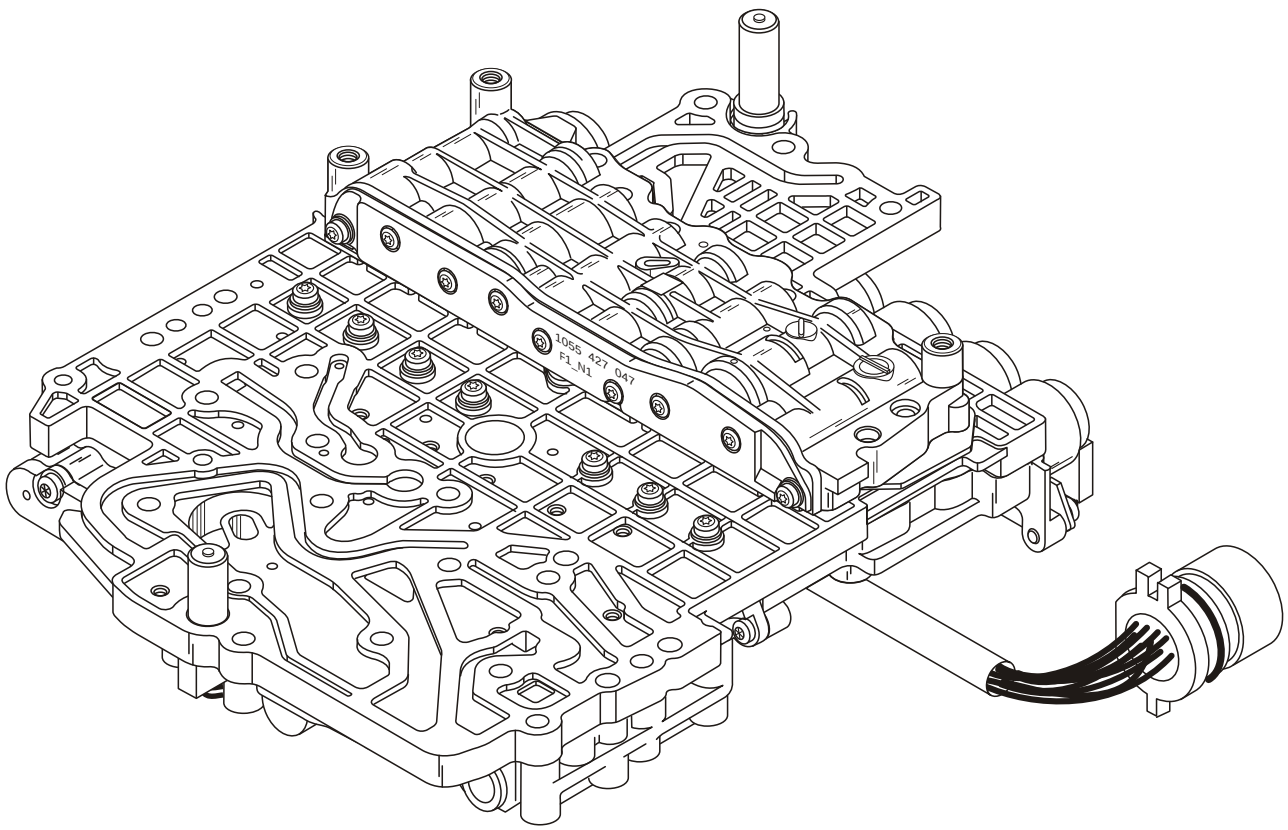


Figure 2

Jaggi

Phoenix

ATSG

Raybestos

TTXE

Lubegard