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# Introduction to the "722.6 Transmission"

The Mercedes 722.6 transmission made its first debut here in the United States in 1996. It is used behind 4, 6, 8 and 12 cylinder gas engines as well as their diesel engines. It is their first completely computer controlled transmission and their first to have a transmission with a converter clutch. This electronically controlled 5 speed automatic transmission consists of 3 compound planetary gear sets, 3 multiple disc clutches, 3 multiple disc brakes and 2 free-wheel clutches, the 5th gear acts as an overdrive gear. The Electronic Transmission Controller (ETC) controls transmission operation matching engine performance during the shift phase. The driver can choose between 2 driving programs, "S" for standard driving programs and "W" for winter driving programs. Winter option provides a second gear start and a higher gear ratio for a reverse movement. Standard mode provides a first gear take off and a lower reverse gear ratio.

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#### **Transmission Identification**

To utilize the 722.6 transmission behind diesel, 4, 6, 8 and 12 cylinder engines, different gear ratios and torque capacities are needed. Various ratios are accomplished in 2 ways:

- 1. Different size axle ratios in the rear differential.
- 2. Different ratio planetary gear sets inside the transmission.

Various amounts of friction and steel plates are used to accommodate the required torque capacity through different heights in the apply piston or snap ring groove location.

Should an incorrect transmission or rear axle ratio be installed into the vehicle, the computer system will observe this as a slipping transmission and produce implausible ratio error codes.

Should incorrect clutch drums or pistons be used, such as a 4 cylinder set up behind a 12 cylinder engine, premature failure of the transmission shall be experienced.

It is for these reasons that proper identification be employed when rebuilding or exchanging this unit.

Use Figure 1 to locate and identify the transmission designation number that is etched into a raised boss area on the left side case of the case.

This number is matched to the engine size which determines the gear ratio and clutch capacity of the transmission.

Similarly, engines are also identified with a designation number. For quick reference, Figure 2 cross references the first 3 digits of the engine designation number to displacement (liter) and cylinder information.

Transmission and Engine designations can be identified and cross referenced to the year, model and in some cases VIN numbers of vehicles equipped with the 722.6 transmission from 1996 to 2002 on pages 5 through 8. Figures 3 and 4 provide planetary gear ratio information for 4, 6, 8 and 12 cylinder engines.

The charts in Figures 5 and 6 cross reference transmission designation numbers to the quantity of frictions and steels contained in each clutch pack. Note, even the torque converter could have 1 to 3 frictions.

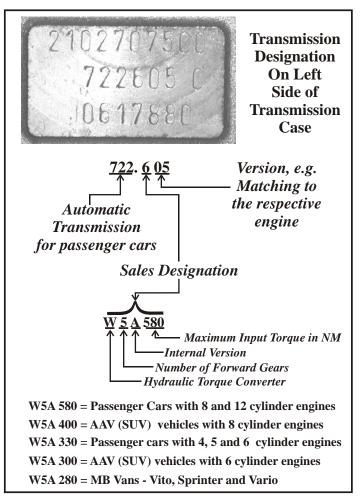


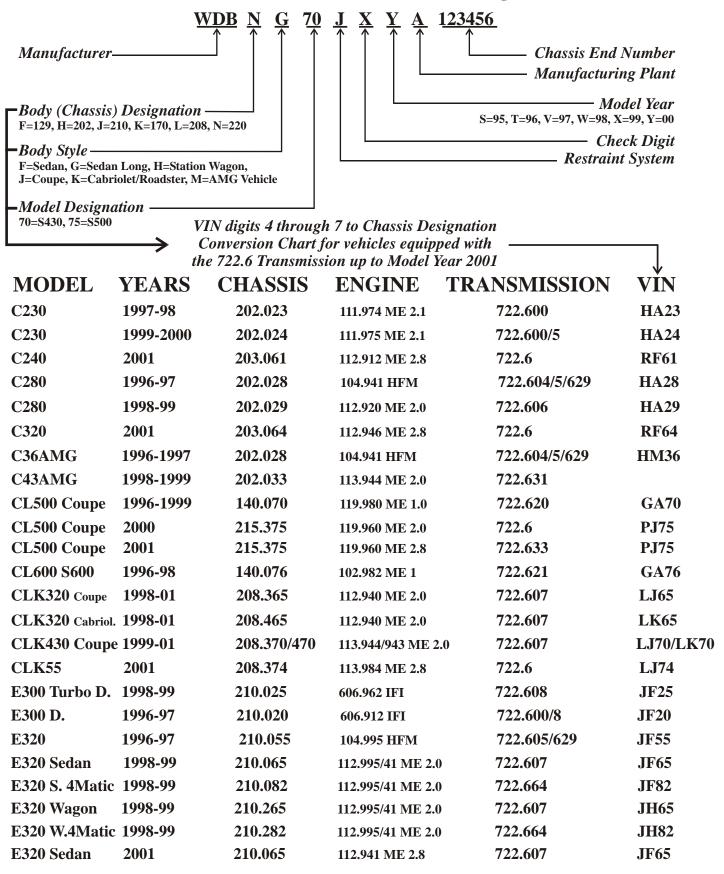
Figure 1

Engine Code	Liter	Cylinder
111	2.2	4
111	2.3	4
104	2.8	In Line 6
112	2.8	V6
606	3.0	6 cyl Diesel
104	3.2	In Line 6
112	3.2	V6
119	4.2	V8
113	4.3	V8
119	5.0	V8
113	5.4	V8
137	5.8	V12
120	6.0	V12

Figure 2



### Vehicle Identification Number (VIN) Designation





MODEL	YEARS	CHASSIS	ENGINE	TRANSMISSION	VIN
E320 S. 4Matie	c 2001	210.082	112.941 ME 2.8	722.664	<b>JF82</b>
E320 Wagon	2001	210.265	112.941 ME 2.8	722.607	JH65
E320 W.4Mati	c 2001	210.282	112.941 ME 2.8	722.664	JH82
E420	1996-97	210.072	119.985 ME 1.0	722.625	<b>JH72</b>
E430	1998-99	210.070	113.940 ME 2.0	722.623	<b>JH70</b>
E430 Sedan	2001	210.070	113.940 ME 2.8	722.623	JF65
E430 S. 4Matie	c 2001	210.083	113.940 ME 2.8	722.623	<b>JF82</b>
E55 AMG	1999	210.074	113.980 ME 2.0	722.623/4/636	
E55 AMG	2001	210.074	113.980 ME 2.8	722.6	<b>JF74</b>
ML320	1998-99	163.154	112.942	722.662	
ML430	1999	163.172	113.942 ME 2.0	722.663	
ML55	2000	163	113 M 2.0	722.6	
S320	1997-99	140.032	104.994 ME 2.1	722.605	GA32
S320	1997-99	140.033 Long	104.994 ME 2.1	722.605	GA33
S420	1996-99	140.032/43	119.9(7)81 ME 1.0	722.622/633	GA32
S430	1998-99	140.0	113. ME 2.0	722.6	
S430	2000	220.170	113.941 ME 2.0	722.6	NG70
S430	2001	220.170	113.941 ME 2.8	722.632	NG70
S500 Coupe	1996-98	140.070	119.970 ME 1.0	722.620	GA70
S500	1996-99	140.051	119.9(7)80 ME 1.0	722.620/ 622	GA51
S500	2000	220.175	113.960 ME 2.0	722.6	NG75
S500	2001	220.175	113.960 ME 2.8	722.6	NG75
S600	1996-99	140.057	120.982 ME 1.0	722.621	GA57
S600 Coupe	1996-97	140.076	120.980/2 ME 1.0	722.621	
S600	2000	220.178	120.982 ME 1.0	722.621	NG78
S600	2001	220.178	137.970	722.628	NG78
SL320	1996-97	126.063	104.991 HFM	722.603/5	FA63
SL500	1996-98	129.067	119.9(7)82 ME 1.0	722.620	FA67
SL500	1999-01	129.068	113.961 ME 2.0	722.620/.624	FA68
SL600	1996-01	129.076	120.983(1) ME 1.0	722.621/32	<b>JH82</b>
SLK230	1998-99	170.447	111.973 ME 2.1	722.605	<b>KK47</b>
SLK230	2000	170.449	111.983 ME 2.1	722.616	KK49
SLK230	2001	170.449	111.983 ME 2.8	722.616	KK49
SLK320	2000	170.465	112.973 ME 2.0	722.618	KK65
SLK320	2001	170.465	112.973 ME 2.8	722.618	KK65
SLK430	1999	170.4	113 ME 2.0	722.6	



### MERCEDES 2002-2004 LINE UP

#### **SEDANS**

C240 Sedan - 2.6L 18-valve V-6 engine C320 Sedan - 3.2L 18-valve V-6 engine C32 AMG Sedan - Supercharged SOHC 3.2L 18-valve V-6 AMG engine E320 Sedan - 3.2L 18-valve V-6 engine E430 Sedan - 4.3L 24-valve V-8 engine E500 Sedan - 5.0L 24-valve V-8 engine E55 AMG Sedan - 5.5L 24-valve V-8 engine S430 Sedan - 4.3L 24-valve V-8 engine S500 Sedan - 5.0L 24-valve V-8 engine S600 Sedan - 5.5L 24-valve V-12 engine S600 Sedan - 5.8L 36-valve V-12 engine S55 AMG Sedan - 5.5L 24-valve V-8 engine

### COUPES

C230 Kompressor Sport Coupe - 1.8L intercooled supercharged DOHC 16-valve inline-4 cylinder engine C230 Kompressor Sport Coupe - 2.3L/ DOHC 16-valve inline-4 cylinder engine CLK320 Coupe - 3.2L 18-valve V-6 engine CLK320 Cabriolet - 3.2L 18-valve V-6 engine CLK430 Coupe - 4.3L 24-valve V-8 engine CLK430 Cabriolet - 4.3L 24-valve V-8 engine CLK55 AMG Coupe - 5.5L 24-valve V-8 engine CLK55 AMG Cabriolet - 5.5L 24-valve V-8 engine CL500 Coupe - 5.0L 24-valve V-8 engine CL55 AMG - 5.5L 24-valve V-8 engine CL55 AMG - 5.5L 24-valve V-8 engine CL600 Coupe - 5.5L 36-valve V-12 engine CL600 Coupe - 5.8L 36-valve V-12 engine

### ROADSTERS

SLK 230 Roadster - 2.3L intercooled supercharged DOHC 16-valve inline-4 engine
SLK320 Roadster - 3.2L 18-valve V-6 engine
SLK32 AMG - intercooled supercharged SOHC 3.2L 18-valve V-6 engine
SL500 Roadster - 5.0L 24-valve V-8 engine
SL55 AMG - intercooled supercharged SOHC 3.2L 18-valve V-6 engine
SL600 Roadster - 6.0L 48-valve V-12 engine
SL500 Silver Arrow Edition - 5.0L 24-valve V-8 engine

### WAGONS

C240 Wagon - 2.6L 18-valve V-6 engine C320 Wagon - 3.2L 18-valve V-6 engine E320 Wagon - 3.2L 18-valve V-6 engine

### LIGHT TRUCKS

ML320 Light Trucks - 3.2L 18-valve V-6 engine ML350 Light Trucks - 3.7L 18-valve V-6 engine ML500 Light Trucks - 5.0L 24-valve V-8 engine ML55 AMG - 5.5L 24-valve V-8 engine G500 Light Truck - 24-Valve V-8 5.0 liter engine G55 AMG - 5.5L 24-valve V-8 engine



### DAIMLER-CHRYSLER 2003-2005 LINE UP

#### 2003 Model Year

Grand Cherokee (WG)	2.7L (5 cylinder) Diesel (ENF)	Trans Code: DGJ	W5J400
Sprinter (VA)	2.7L (5 cylinder) Diesel (EX9)	Trans Code: DGJ	W5A380
2004 Model Year			
Sprinter (VA)	2.7L (5 cylinder) Diesel (EX9)	Trans Code: DGJ	W5A380
Crossfire (ZH)	3.2L (6 cylinder) Gas (EGX)	Trans Code: DGU	W5A330
2005 Model Year			
Sprinter (VA)	<ul> <li>2.7L (5 cylinder) Diesel (EX9)</li> <li>5.7L (8 cylinder) Gas (EZB)</li> <li>5.7L (8 cylinder) Gas (EZB)</li> <li>3.7L (6 cylinder) Gas (EKG)</li> <li>3.0L (6 cylinder) Diesel (EXL)</li> <li>3.2L (6 cylinder) Gas (EGX)</li> </ul>	Trans Code: DGJ	W5A380
Chrysler 300C (LX)		Trans Code: DGJ	W5A580
Dodge Magnum (LX)		Trans Code: DGJ	W5A580
Grand Cherokee (WK)		Trans Code: DGJ	W5A580
Grand Cherokee (WH)		Trans Code: DGJ	W5J400
Crossfire (ZH)		Trans Code: DGU	W5A330



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### Front, Center and Rear Planetary Assembly Tooth Counts

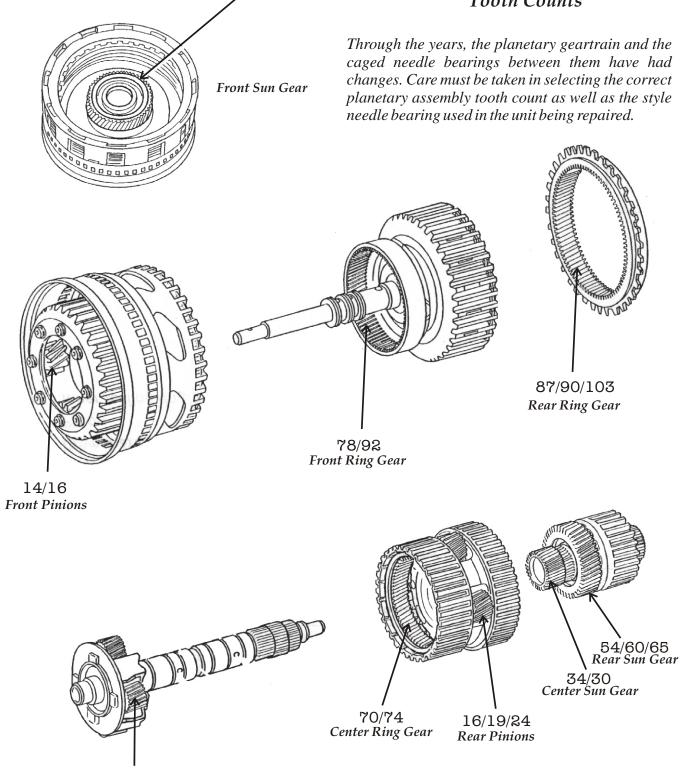


Figure 3

18/22 Center Pinions

### AUTOMATIC TRANSMISSION SERVICE GROUP

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# 9

#### The 722.6 North American Gear Ratios

4 Cyl, 6 Cyl and diesels including SUV's

**Ratio:Small NAG** 

1 Gear: 3.932

2 Gear: 2.408

3 Gear: 1.486

4 Gear: 1.0

**Rev.** : 3.1

5 Gear: 0.83

**Ratio:Large NAG** 

1 Gear: 3.59

2 Gear: 2.19

3 Gear: 1.41

5 Gear: 0.83 Rev. : 3.16

4 Gear: 1.0

8 Cyl and 12 Cyl engines

#### CAUTION

These 2 gear boxes are NOT interchangeable as gear ratio errors shall occur. Also, the vehicle speed sensor is located in the rear differential housing. These rears have different gear ratios as well. If the rear has been exchanged incorrectly, it too will produce gear ratio errors failsafing the unit.

NOTE: Interchanging TCM'S between 4 & 6 Cylinders vehicles with 8 & 12 Cylinder vehicles will also result in incorrect gear ratios. 4 & 6 Cylinder AMG Vehicles usually have 8 cylinder packages.

	722.600/660		722.601/602/603/610		722.604/606/609/617	
	Friction Discs	Steel Discs	Friction Discs Steel Discs		Friction Discs Steel Discs	
K1	3	4	3	4	4	5
K2	4	5	3	4	4	5
K3	3	4	3	4	4	5
<b>B1</b>	2	3	2	3	3	4
B2	4	5	4	5	4	5
<b>B3</b>	3	4	3	4	4	5
Conv. Clutch		2	1	2	2	3

Figure 4

Figure 5



	722.605/607/608/611/614 618/662/664/699		722.665		722.620/621/624/626/627 628/630/633/636/666		
	Friction Discs	Steel Discs	Friction Discs	Steel Discs	Friction Discs	Steel Discs	
K1	4	5	4	5	6	7	
K2	4	5	4	5	6	7	
K3	4	5	4	5	5	6	
B1	3	4	3	4	4	5	
B2	5	6	4	5	5	6	
<b>B3</b>	4	5	4	5	5	6	
Conv. Clutch		3	2	3	2	3	

	722.622/ 631/632/		722.629/634/661		
	Friction Discs	Steel Discs	Friction Discs	Steel Discs	
K1	5	6	5	6	
K2	5	6	5	6	
K3	4	5	4	5	
<b>B1</b>	3	4	4	5	
B2	5	6	5	6	
<b>B3</b>	5	6	5	6	
Conv. Clutch	2	3	2	3	

Figure 6



### The Park Lock Interlock Linkage (PLIL)

The Park Lock Interlock Linkage is designed to lock the transmissions internal detent plate in the Park position after the selector lever has rested in Park and the brake pedal is released. (*As an added safety measure, the Steering Lock Interlock System prevents the removal of the key if the parking lock is not engaged*).

When the ignition key is turned and the brake pedal is depressed, the latch lever at the end of the cable system inside the transmission is lifted off of the internal detent lever disengaging the Park lock.

The Park Lock Interlock Linkage (Figure 7) passes through the case (Figure 8) connecting the brake cable to the latch lever used to block the detent lever. A screwdriver would be inserted to release a locking tab freeing the cable from the PLIL. On the later versions, the end of the cable (Figure 9) would twist lock into the PLIL.

This PLIL has a common problem allowing transmission fluid to leak past its seal. It has since been eliminated in later vehicles as shown in Figure 10. For earlier models that have the PLIL, part numbers for the early and late versions are provided in Figure 7. Refer to Figure 11 when replacing a PLIL.

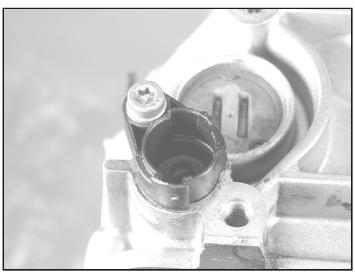


Figure 8



Figure 9

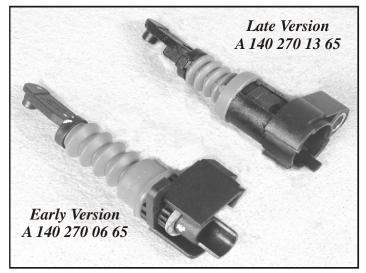


Figure 7

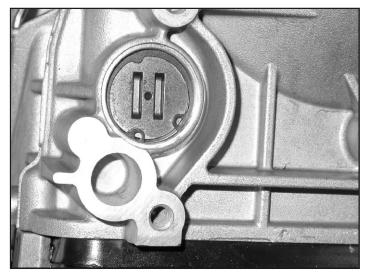
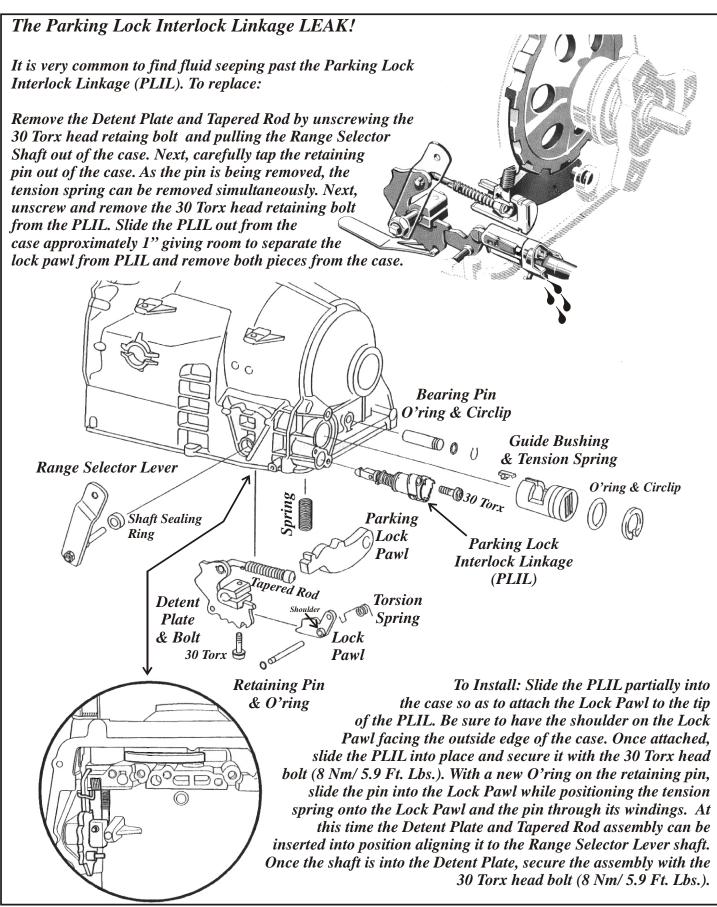


Figure 10





### Figure 11 AUTOMATIC TRANSMISSION SERVICE GROUP



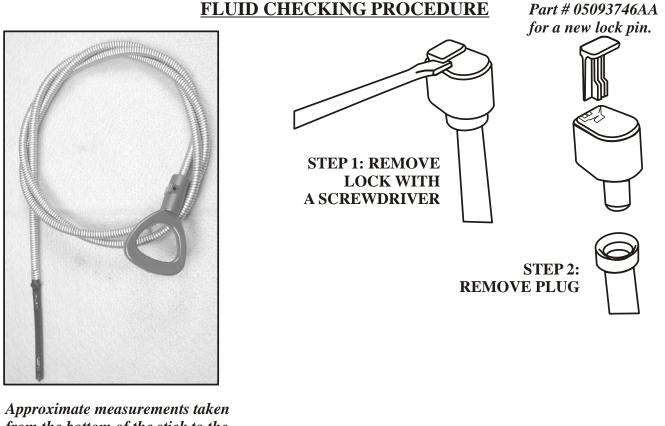
# MAINTENANCE:

Recommended Fluid...Mercedes Benz Synthetic Automatic Transmission Fluid...Part Number 001 989 21 03 10 or a suitable substitute.

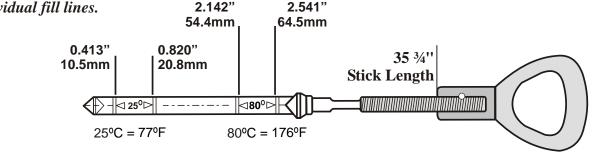
The transmission does NOT come equipped with a dip stick for checking fluid level. The filler tube has a locking plug in it from the factory. When fluid level needs to be checked use a screw driver to pry the lock from the plug and remove the plug as seen below.

Purchase the dip stick from a Mercedes Benz dealer using part number *140 589 15 21 00* shown below. While in Park at idle, use this **tool** to check fluid level by inserting the dip stick into the filler tube until fully seated, wait 3 seconds, then remove the dip stick and check the fluid level indication on the dip stick.

Dipstick tool for Sprinter & Crossfire - 8863A, 300C (LX) - 9336. Grand Cherokee comes equipped with a dipstick. Sprinter/Crossfire uses Trans fluid 5127382AA and can be topped off with no more than 1 quart of Type 4. The 300C and the Grand Cherokee uses Chrysler type 4 fluid.



Approximate measurements taken from the bottom of the stick to the individual fill lines. 2



#### STEP 3: USE THIS TOOL TO CHECK FLUID LEVEL PART NUMBER: 140 589 15 21 00

Figure 12 AUTOMATIC TRANSMISSION SERVICE GROUP



#### **Transmission Disassembly Tips**

It is advised to first remove the valve body/conductor plate assembly from the transmission clearing the Hall Effect Sensors from the barrel of the case.

Begin by removing (2) #45 Torx bolts used to attach the converter housing to the main case as shown in Figure 13. *During assembly, these bolts tighten to 14.7 ft. lbs* (20Nm.)

Next, rotate the transmission on it's back and remove (6) # 30 Torx bolts and pan clamp down fixtures (Mercedes calls these spacers "sprags") and then remove the pan (See Figure 14). When re-attaching the pan, these pan bolts tighten down to 5.9 ft. lbs. (70.74 inch lbs./8 Nm).

With the pan set aside, the filter can be removed with an upward pull (Figure 15). Using a 7 mm socket (9/32" works also), unscrew the vehicle harness connector sleeve's attaching bolt and pull the sleeve out of the case (Mercedes calls this sleeve a "Guide Bushing").

Remove the Valve Body's (10) # 30 Torx retaining bolts. 6 across the top and 4 across the bottom (See Figure 16). When re-attaching these valve body bolts, tighten down to 5.9 ft. lbs. (70.74 inch lbs./8 Nm).

After the valve body attaching bolts have been removed, the valve body may be lifted up off the case and disassembly of the transmission can begin. To continue with transmission disassembly turn to page 27. For valve body information, continue to page 14.

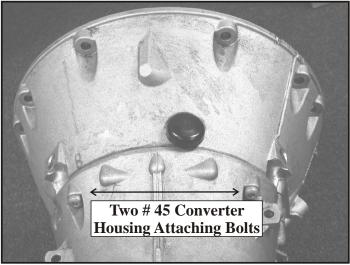


Figure 13

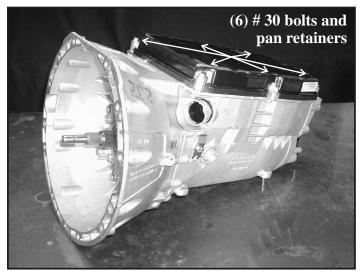


Figure 14

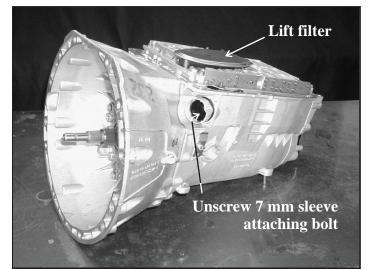


Figure 15



Figure 16





### Valve Body Tips

At the start of production in March of 1995, the valve body (*Electrohydraulic Control Unit* - Figure 17) has undergone several distinct design changes for increased durability and driveability. A number stamped into the lower valve body housing near the manual valve (See Figure 18) can be used to identify <u>some</u> of these changes. Their known explanations and further visual identifications are as follows:

140 277 32 01 = This is the first design valve body which began in March 1995. Other identifiable features can be seen at the B-2 Shift Valve bore line up area. It has two exhaust ports cast into the housing over the valve as well as a round exhaust hole below the line up (See Figure 18). This style valve body did not come with a spring loaded plastic check valve in the encircled area shown in Figure 19 of the lower valve body housing.

**140 277 34 01** = This second design valve body was released in March of 1996. The B2 Shift Valve bore now has only one exhaust port cast over the valve and the exhaust hole below the valve is now irregular in shape (See Figure 20). This design contains the added spring loaded plastic check valve. This check valve was added to eliminate harsh 3-2 downshift complaints by keeping pre-fill oil behind the K3 piston improving the shift timing (Figure 21).

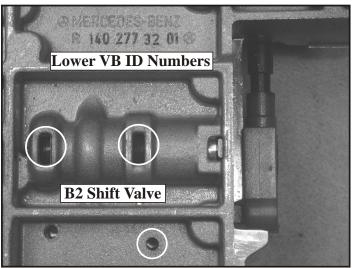


Figure 18

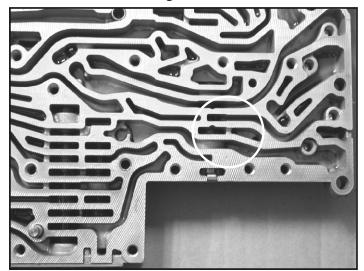


Figure 19

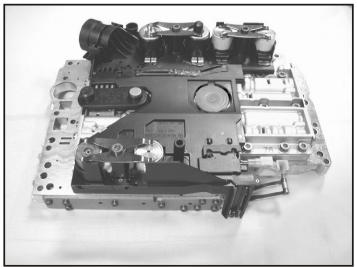


Figure 17

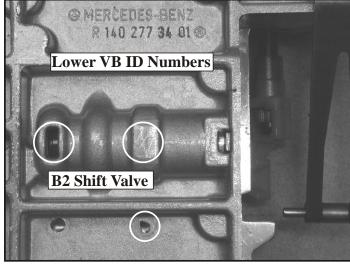


Figure 20





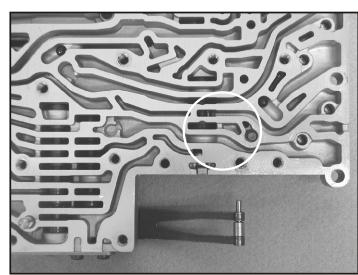


Figure 21

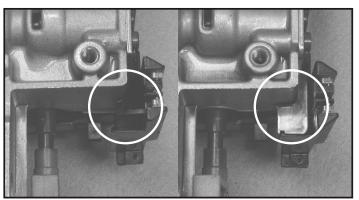


Figure 22

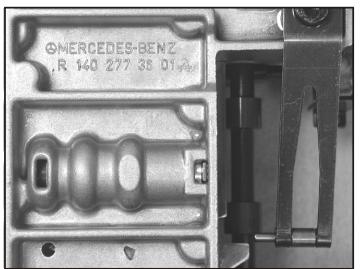


Figure 23

### Valve Body Tips continued:

**140 277 34 01** = One month later in April of 1996, the spacer plate received a minor design change. The modification extended the spacer plate in the manual valve area as seen in Figure 22. This extension of the plate acts as a "arm" adding support for the reed switch built into the conductor plate.

**140 277 36 01** = In July of 1996, this re-designed valve body (Figure 23) was released for improved garage shifts (initial engagements). Both the upper and lower valve body housings have been modified as well as the transmission control module to accomplish this improvement (See Figures 24 and 25). If this design valve body is used in an earlier vehicle without updating the control module, excessively delayed engagements will be experienced.

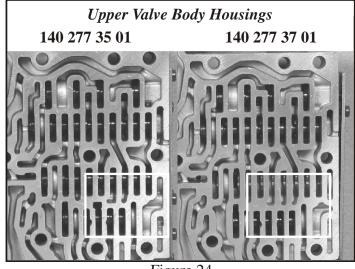


Figure 24

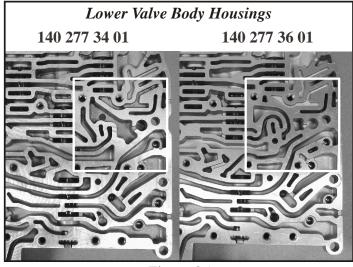


Figure 25



#### Valve Body Tips continued:

#### Spacer Plates:

Half moon notches are used on the edge of the spacer plate near the manual valve area for identification purposes. The following information is what has been observed at the time of printing.

#### Spacer Plate Part # 140 277 37 14

This plate belongs to the first design valve body with the lower valve body housing number **140 277 32 01.** This spacer plate has 3 half moon notches and only one hole in the plate in the area where the spring loaded check valve was added in 3/96 (See Figure 26).

#### Spacer Plate Part # 140 277 38 14

This spacer plate accommodates the 3/96 lower valve body housing **# 140 277 34 01** with the spring loaded check valve. It can be identified with **no** notches and two holes in the check valve area (See Figure 27).

#### Spacer Plate Part # 140 277 40 14

The same as the above spacer plate except this plate has the extended arm for increased reed switch support (See Figure 28).

#### Spacer Plate Part # 140 277 39 14

This spacer plate matches with the upper and lower valve body housing changes that took place in 7/96 for improved garage shifts and can be identified with one half moon notch (See Figure 29).

Caution: These parts can not be mismatched. Refer to the "Valve Body Recap and Part # Chart" on the following page for a complete overview.

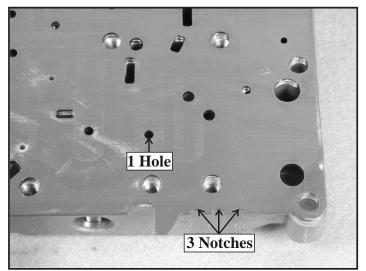


Figure 26

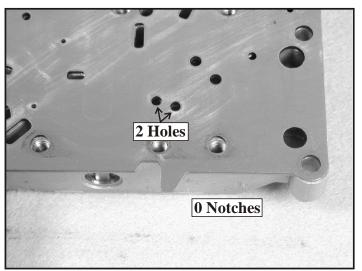


Figure 27

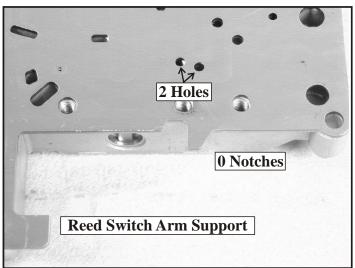


Figure 28

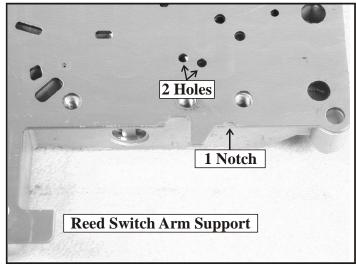


Figure 29

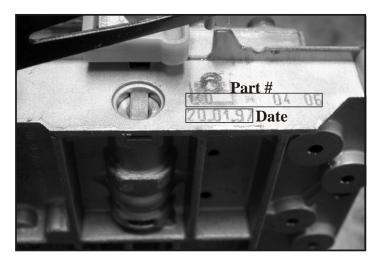


### Valve Body Part # and Recap Chart

Electrohydraulic Control Unit (1)	Valve Body (2)	Upper Valve Body Housing (3)	Lower Valve Body Housing (3)	Spacer Plate (4)	Comments
140 270 02 06	140 270 07 57	140 277 33 01	140 277 32 01	140 277 37 14	First Production 3/95
140 270 03 06	140 270 08 57	140 277 35 01	140 277 34 01	140 277 38 14	3/96 change which added the spring loaded check valve (part # 126 277 44 89) in the lower valve body housing
140 270 05 06	140 270 10 57	140 277 35 01	140 277 34 01	140 277 40 14	4/96 change which extended the spacer plate for improved reed switch support
140 270 04 06 (5)	140 270 09 57	140 277 37 01	140 277 36 01	140 277 39 14	7/96 change which improved garage shift. Modifications in both housings occurred.

(1). Electrohydraulic Control Unit includes the VB, solenoids and conductor plate. The part # for the entire assy. is *etched* or *printed* into the side of the lower valve body housing near the manual valve area (See Figure 30).

- (2). This part number is for the valve body only and it is not marked anywhere on the VB.
- (3). Part numbers are cast into the upper (Figure 31) and lower housings (Figures 18, 20 & 23).
- (4). Spacer plate identified by half moon notches (half circles).
- (5). If using this Electrohydraulic Control Unit on any earlier vehicle, it must be accompanied with a modified control module or excessively delayed engagements *may* occur.



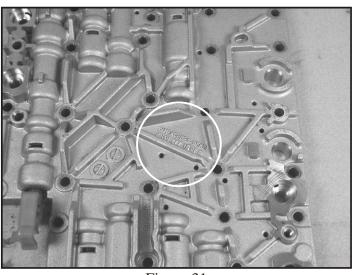


Figure 30

Figure 31

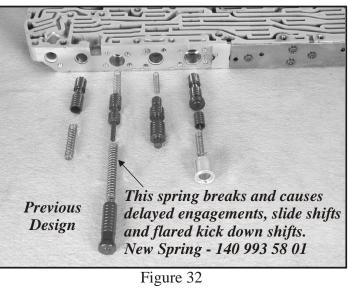


### Valve Body Tips continued:

Parts and Labor Guides provide only one part number for the valve body up to year 1998, part # 140 270 04 06. What has been observed to date beyond the material presented on the previous pages is a redesign of a valve Mercedes calls the "Control Valve Pressure Regulating Valve" in the lower valve body. The original line up is pictured in Figure 32. The new design can be seen in Figure 33. At the time of printing two valve bodies had this redesigned valve line-up. One had a 2 notch spacer plate while the other had 5 half round notches (See Figure 34). Both had a lower valve body casting number of **R 140 277 38 01** (See Figure 35) and an upper valve body casting number of 140 277 3701 (See Figure 36). The 2 notch plate had a production date etched into the side of the lower casting of *December 10, 1998* while the 5 notch plate had September 19, 2000 (See Figure 37). These valve bodies may be found in earlier vehicles after receiving a service by the dealer. An update TCM to match the new valve body would also have been installed.

Another easily identifiable change that took place are the notches in the end plates. The previous design had two square notches as shown in Figure 38. The present design has two half round notches as seen in Figure 39.

The spring used in the previous design valve line up that's pictured in Figure 32 is known to break. This can cause a delayed forward and reverse engagement, slide shifts and kick down flared shifts. Since delayed engagements can be produced by other causes such as undersized K3 clutch drum sealing rings on the output shaft, a defective Transmission Range Recognition Switch (TRRS), a mis-matched used or new TCM installed into the vehicle or a malfunctioning TCM, it would be easiest to first check for Control Valve Pressure Regulator Valve spring breakage. This can be done easily even with the valve body still in the car. Simply drop the pan and remove the passenger side rear cover plate on the valve body as you see in Figure 40 and inspect the spring. If it is broken, remove all the pieces and measure the length. It should have a normal free length of approximately 52.19mm (2.055"). If it measures considerably less, the valve body will need to be dis-assembled to locate the missing pieces. A new spring can be purchased from Mercedes under OEM part number 140 993 58 01.



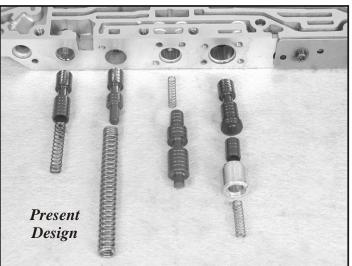


Figure 33

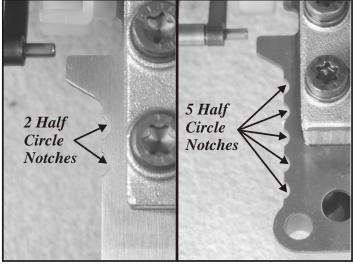


Figure 34





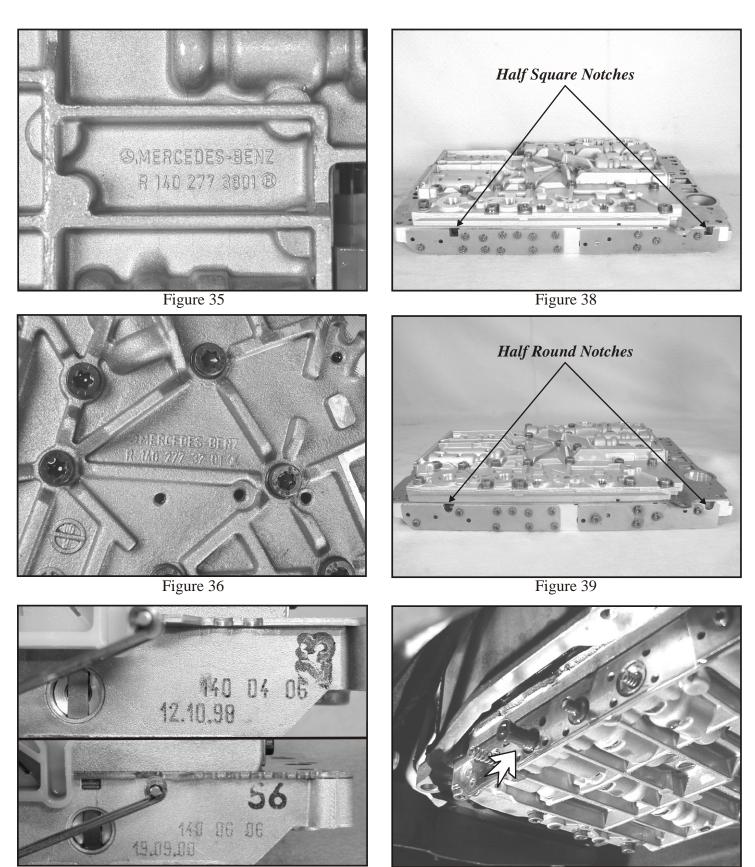
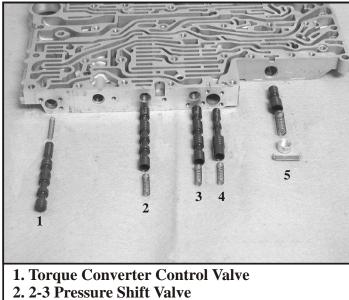


Figure 37

Figure 40

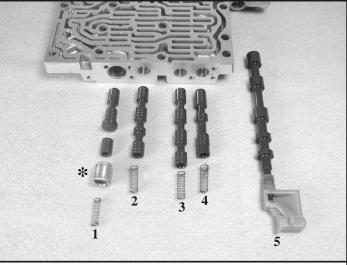


Lower Valve Body Valve Identification



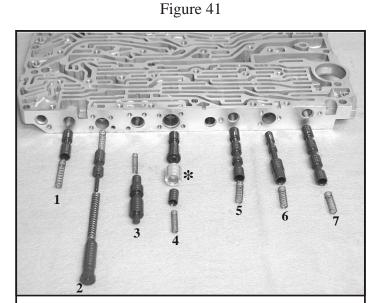
- 3. 2-3 Command Valve
- 4. 2-3 Holding Pressure Shift Valve
- 5. B2 Shift Valve

Upper Valve Body Valve Identification



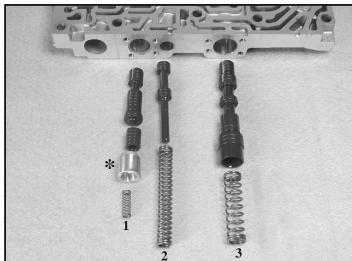
- 1. 3-4 Overlap Regulating Valve
- 2. 3-4 Pressure Shift Valve
- 3. 3-4 Command Valve
- 4. 3-4 Holding Pressure Shift Valve
- 5. Manual Valve

Figure 43



- 1. Shift Solenoid Feed Pressure Regulator Valve
- 2. PR Solenoid Feed Pressure Regulator Valve
- 3. Shift Pressure Regulator Valve
- 4. 1-2/4-5 Overlap Regulating Valve
- 5. 1-2/4-5 Shift Pressure Shift Valve
- 6. 1-2/4-5 Holding Pressure Shift Valve
- 7. 1-2/4-5 Command Valve

Figure 42



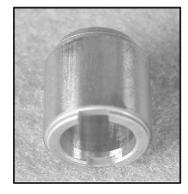
- 1. 2-3 Overlap Regulating Valve
- 2. TCC Limit Valve
- **3. Pressure Regulator Valve (Working Pressure)**

Figure 44





\* When installing the Overlap Regulating Valve sleeves (Figures 38 - 40), ensure that the two slots on the end face point outward as shown in Figure 41.



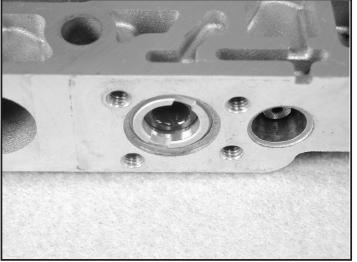


Figure 41

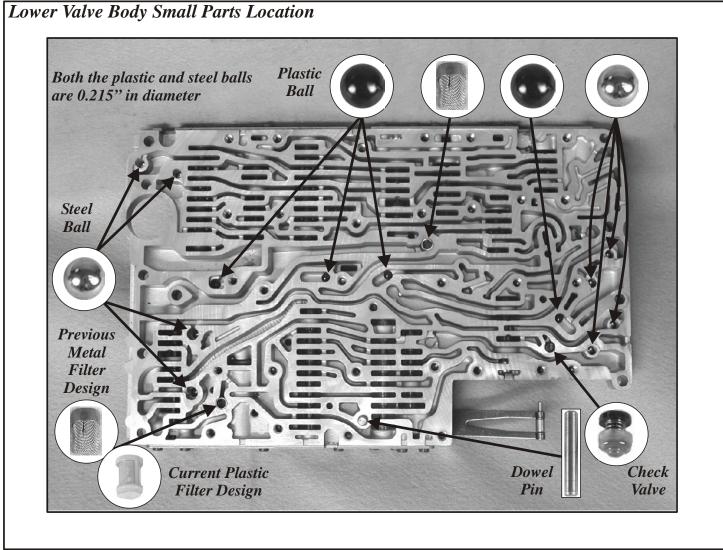


Figure 42



### Valve Body Assembly Tips

If the valves have been removed for inspection and cleaning, during assembly, tighten the 20 Torx head cover plate bolts to 4 Nm (35.37 inch lbs.). The 29 #30 Torx head bolts holding the valve body halves together torque down to 8 Nm (70.74 inch lbs.).Remember to install the 2 pressure control solenoid screens, one in each port (See Figure 47). Once assembled, the conductor plate (Figure 48) can be positioned onto the valve body. If re-using the original conductor plate, there are several visual checks that need to be made.

1. A previous design conductor plate had exposed the Hall Effect Sensor's circuit to the main body of the conductor plate (See Figure 49). This style plate will need to be updated to one that had these circuits covered as seen in Figure 50 (*Part #A 140 270 0861*).

2. Inspect the Hall Effect Sensors for external damage. If internal damage to the transmission had occurred such as "planetary failure," the sheet metal windows on the drums that excite the sensors can crash against the sensor tip breaking its casing (See Figure 51).

3. Inspect the "Leaf Spring" on the back side of the Hall Effect Sensors for any defects or damage. This is used to as a tension device to hold steady the sensors maintaining the proper air gap between the sensor tip and sheet metal windows (See Figure 52).

4. Inspect and correct all solenoid contacts for damage or corrosion (See Figure 53)

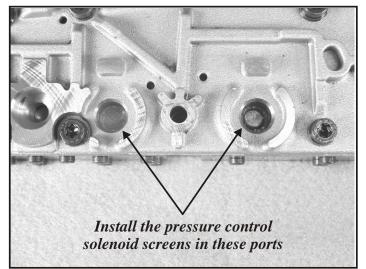


Figure 47

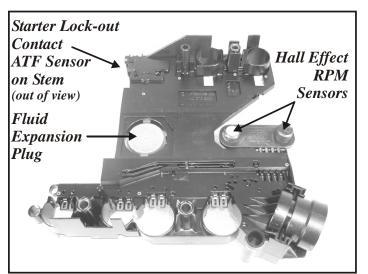


Figure 48

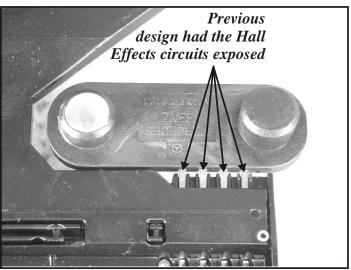


Figure 49

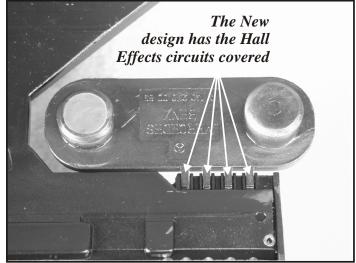


Figure 50





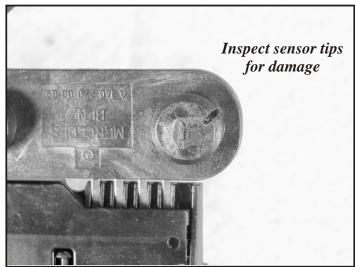


Figure 51

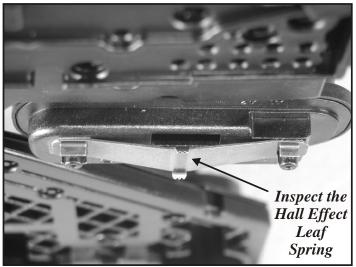






Figure 53

### Valve Assembly Body Tips continued:

5. Inspect all solenoid pockets in the conductor plate to ensure that the sleeves have not distorted (out of round) or that there are any other types of poor casting defects protruding into the solenoid area that would prevent the solenoid from fully seating in position (See Figure 54).

6. Inspect the terminal leads in the connector pocket for bent, broken or missing terminals (See Figure 55). Inspect the threaded hole in the connector pocket to ensure that the threads are not pulled out or stripped out (See Figure 55).

Using Figures 56 through 58, inspect each solenoid for proper operation before installing them into the valve body. Refer to Figure 98 on page 70 for resistance values of all the solenoids.

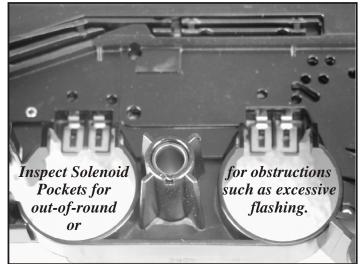


Figure 54

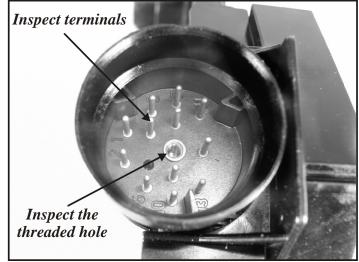
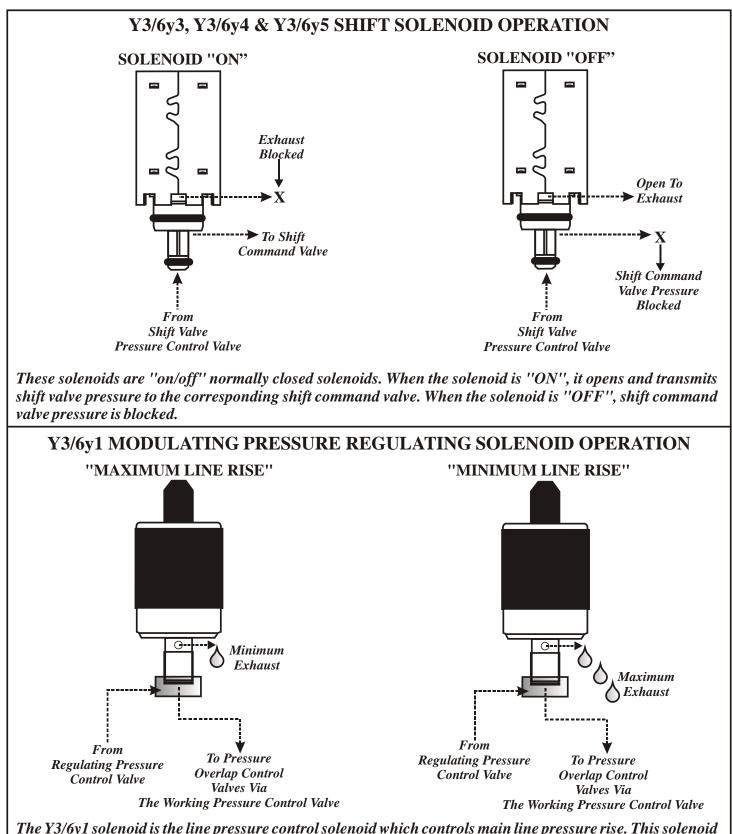


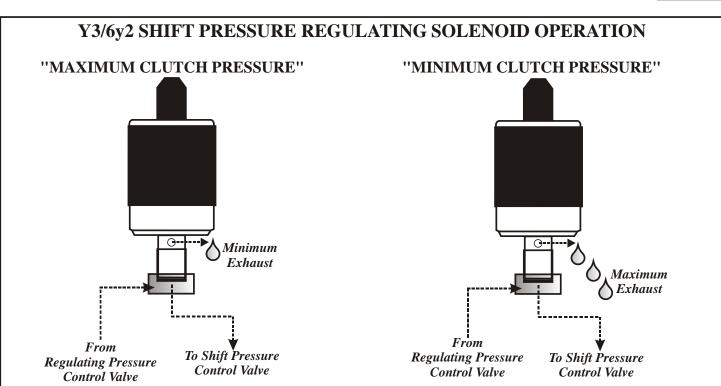
Figure 55



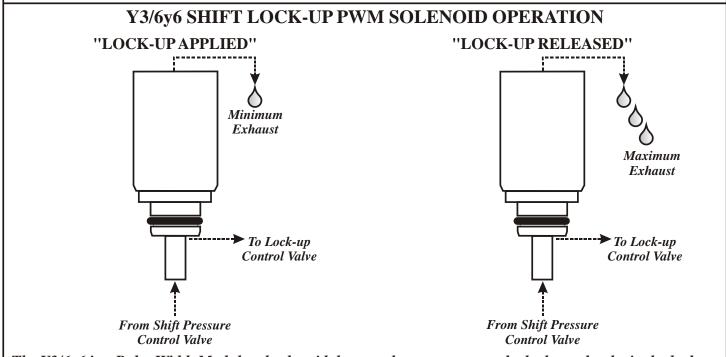


The Y3/6y1 solenoid is the line pressure control solenoid which controls main line pressure rise. This solenoid is a modulated solenoid which is supplied a variable current flow from the TCM. When the solenoid is at minimum exhaust, line pressure is high. When the solenoid is at maximum exhaust, line pressure is low.





The Y3/6y2 solenoid regulates pressure to all clutches and bands to control the pressure cutback during a shift as well as the clamping force needed to prevent a clutch or band from slipping. This solenoid is a modulated solenoid which is supplied a variable current flow from the TCM. When the solenoid is at minimum exhaust, clutch pressure is high. When the solenoid is at maximum exhaust, clutch pressure is low.

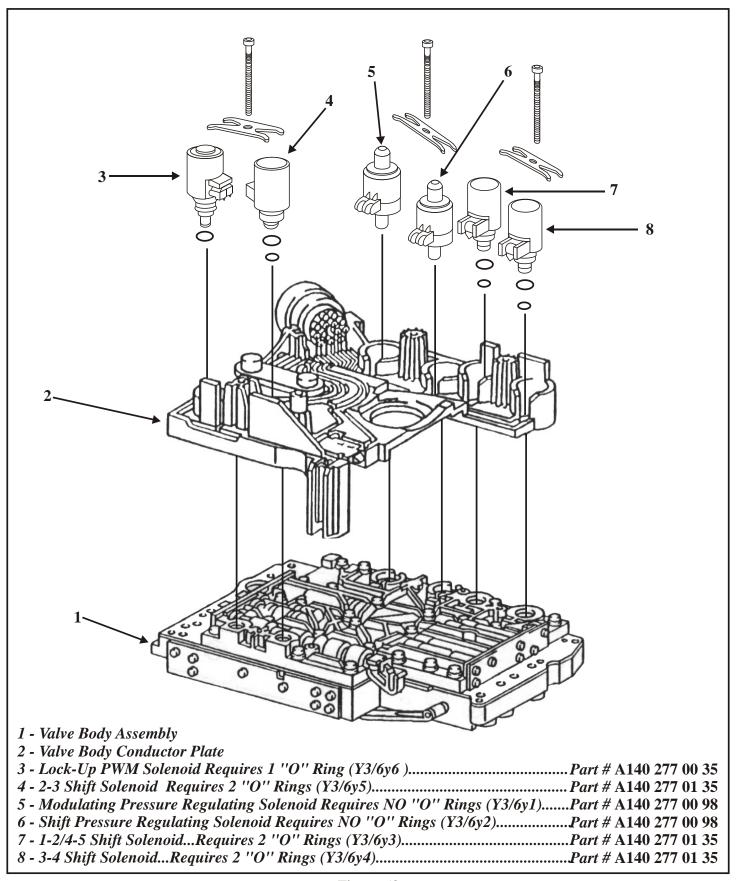


The Y3/6y6 is a Pulse Width Modulated solenoid that regulates pressure to the lock-up clutch via the lock-up control valve where converter clutch apply pressure is controlled in order to ''ramp'' the lock-up clutch on and off making for a smooth converter clutch apply and release. When the solenoid is at maximum exhaust, lock-up is released.. When the solenoid is at minimum exhaust, lock-up is fully applied.

### Figure 57 AUTOMATIC TRANSMISSION SERVICE GROUP







# Figure 58 **AUTOMATIC TRANSMISSION SERVICE GROUP**





#### Valve Body Assembly Tips continued:

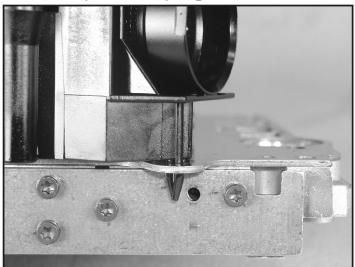


Figure 59

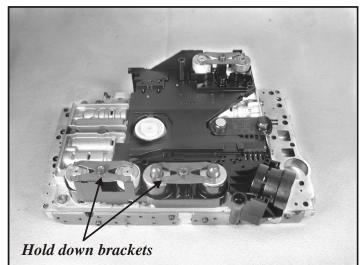


Figure 60

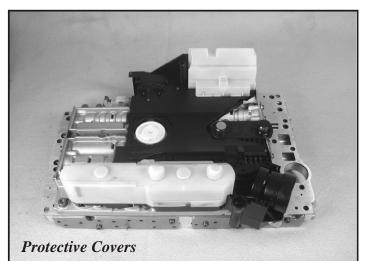


Figure 61

Once the conductor plate and solenoids have been determined to be useable, position the conductor plate onto the valve body (Figure 58) snapping the tab located on the conductor plate beneath the terminal housing into the spacer plate as seen in Figure 59.

Lube the O rings on the solenoid and snap them in place. Place the hold down brackets onto the solenoids (See Figures 58 and 60). Using a # 30 Torx, tighten the hold down bolts to 8 Nm (70.74 inch lbs.).

Install the solenoid covers as seen in Figure 61. Earlier valve bodies do not have these covers. These were added as a measure to protect the electrical connections from shorts caused by metal particles that may be floating in the fluid. These covers are not available separately for retrofitting. When a new conductor plate is purchased, covers should accompany the plate. As well as when a new valve body is purchased.

For additional information concerning the purpose of the "Float - Fluid Expansion Plug" See Figure 63 on the following page.

#### Transmission Disassembly Tips continued:

Disassembly of the transmission can begin after completing the steps outlined on page 13 Figures 13 through 16. Continue now by removing the 15 outside diameter #45 Torx head bolts from inside the converter housing as seen in Figure 62 and go to page 29.



Figure 62



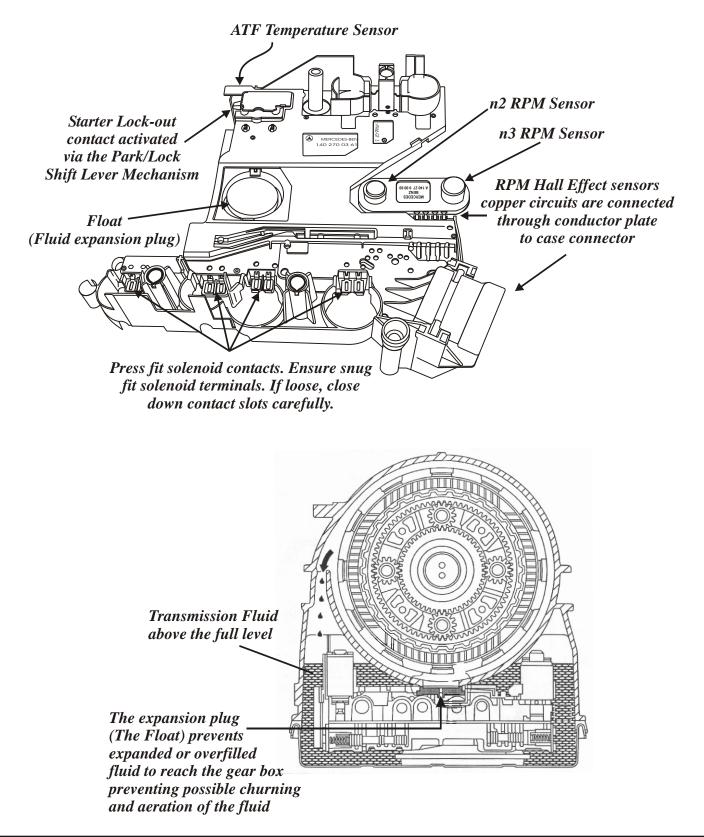


Figure 63





# Disassembly and Reassembly Tips INTERNAL COMPONENTS QUICK TECH SHEETS

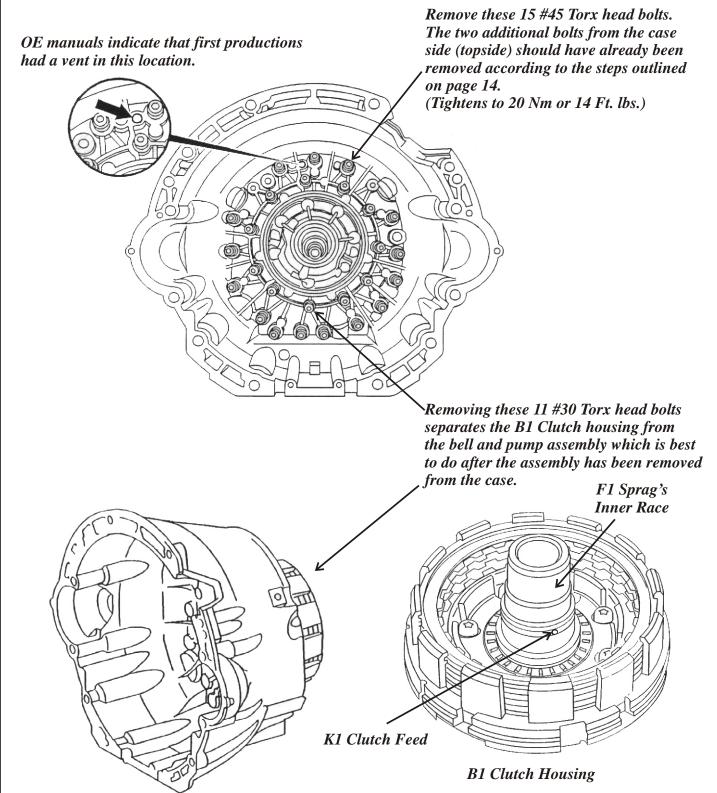


Figure 64





The 7 #45 Torx head bolts which The 11 #30 Torx head bolts which separates Pump Body from the bell and pump assembly separates the B1 Clutch housing from the bell and pump assembly. (Tighten to 20 Nm or 14 Ft. lbs.) m (Tightens to 8 Nm or 5.8 Ft. lbs.) D To Cooler **Alignment Pin** Not shown in the clutch line up here is a bottom cushion plate which sits at the bottom of the pack like a bowl. See the cross sectional view in lower right corner. Inner lip on snap ring towards pump keeps the. piston return spring Cooler Return centered. B1 Clutch Oil Circuit (Use air here to remove piston) Selective Snap Ring. **Cushion Plate** The B1 clutch stack varies with either **Pressure Plate** placed at the 2, 3 or 4 frictions. Clutch pack clearance bottom as a specifications are 0.5 to 1.7mm or bowl not as .020 to .067 inches with the 2 and 3 a cone. friction stack up. The 4 friction stack up is 0.5 to 1.8mm or .020 to .070 inches. Clutch clearance is adjusted by the retaining selective snap ring. There are 4 sizes available: 2.5 mm - .098" - A 140 994 87 40 2.8 mm - .110" - A 140 994 88 40 3.1 mm - .123" - A 140 994 89 40 3.7 mm - .146" - A 140 994 30 35

# Figure 65 AUTOMATIC TRANSMISSION SERVICE GROUP



32

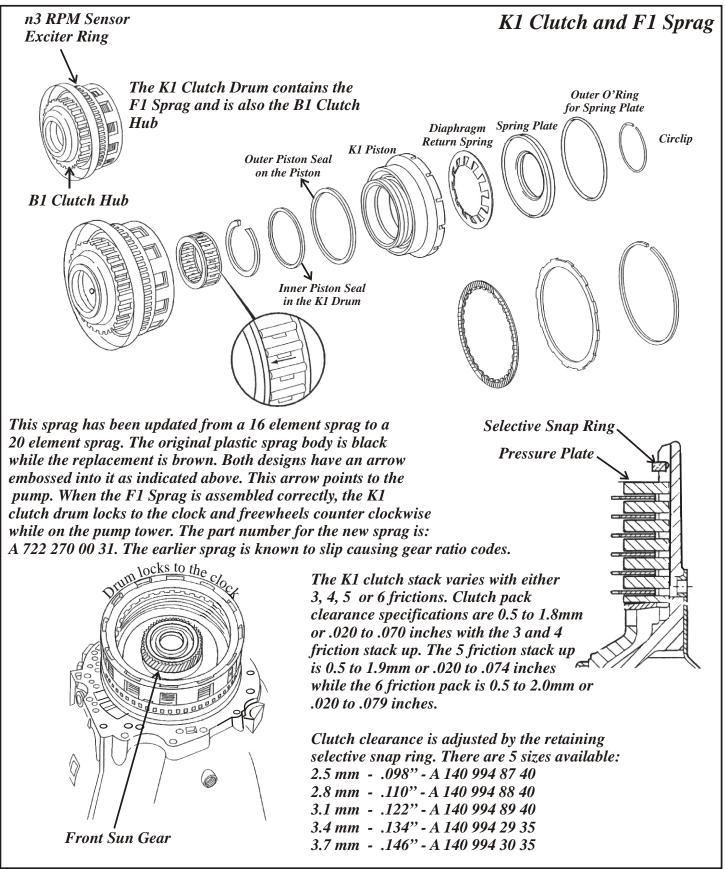
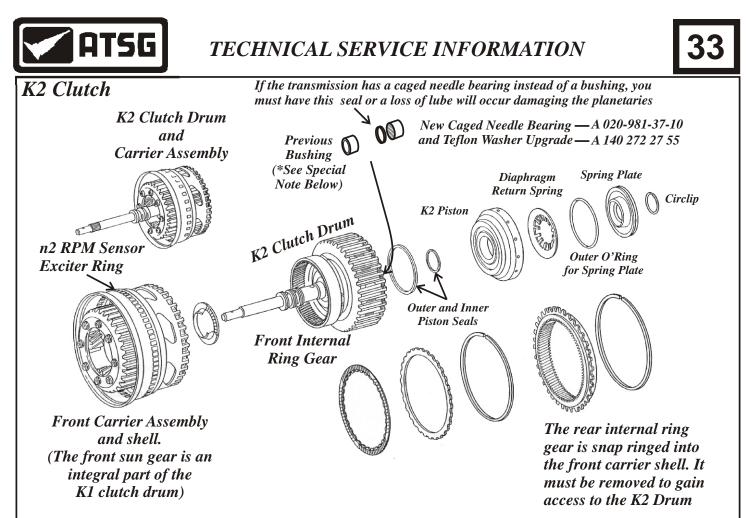


Figure 66



Special Note: It is common to encounter premature failure of the bushing inside the K2 clutch drum which pilots the output shaft causing complete planetary failure. Later models have been upgraded to a Teflon sealing ring and caged needle bearing arrangements. Upgrade packages for early designs are available from Mercedes. The upgrade package includes a new K2 clutch drum and output shaft as the pilot diameter changed dimensions to accommodate the caged needle bearing. You must select the correct gear ratio package to avoid gear ratio errors after rebuild. If a complete failure has not occurred with the bushing style K2 clutch drum and the bushing needs to be replaced, the bushing can be acquired through aftermarket sources such as Sonnax or Independent transmissions.

The K2 clutch stack varies with either 3, 4, 5 or 6 frictions. Clutch pack clearance specifications are 0.5 to 1.7mm or .020 to .067 inches with the 3 and 4 friction stack up. The 5 and 6 friction stack up is 0.7 to 1.8mm or .027 to .070 inches.

Clutch clearance is adjusted by the retaining selective snap ring. There are 5 sizes available: 2.2 mm - .086" - A 140 994 92 40 2.5 mm - .100" - A 140 994 93 40 2.8 mm - .112" - A 140 994 94 40 3.1 mm - .124" - A 140 994 32 35 3.4 mm - .135" - A 140 994 33 35

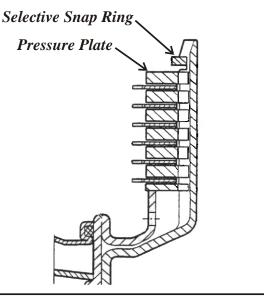
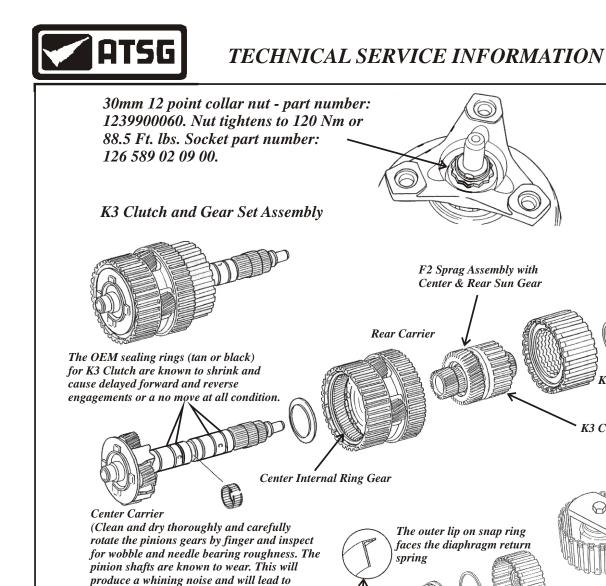


Figure 67



Shown in the cross sectional view of the K3 clutch pack below, a 4 tab cushion plate is installed in the drum like a bowl first followed by a flat steel plate measuring 1.8 mm or 0.069" in thickness. The other 4 steel plates measure 3.5 mm or 0.136" in thickness.

K3 Clutch

(F2 Sprag)

K3 Clutch Drum

K3 Clutch Hub

The K3 clutch stack varies with either 3, 4 or 5 frictions. Clutch pack clearance specifications are 0.7 to 1.9 mm or.028 to .075 inches with the 3 and 4 friction stack up. The 5 friction stack up is 0.7 to 2.0 mm or .028 to .079 inches.

complete planetary destruction).

Clutch clearance is adjusted by the retaining selective snap ring. There are 5 sizes available: 1.9 mm - .074" - A 140 994 99 40 2.2 mm - .086" - A 140 994 10 35 2.5 mm - .098" - A 140 994 11 35 2.8 mm - .110" - A 140 994 35 35 3.1 mm - .122" - A 140 994 36 35

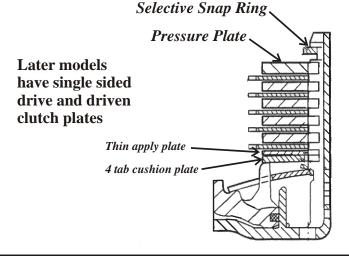


Figure 68



35

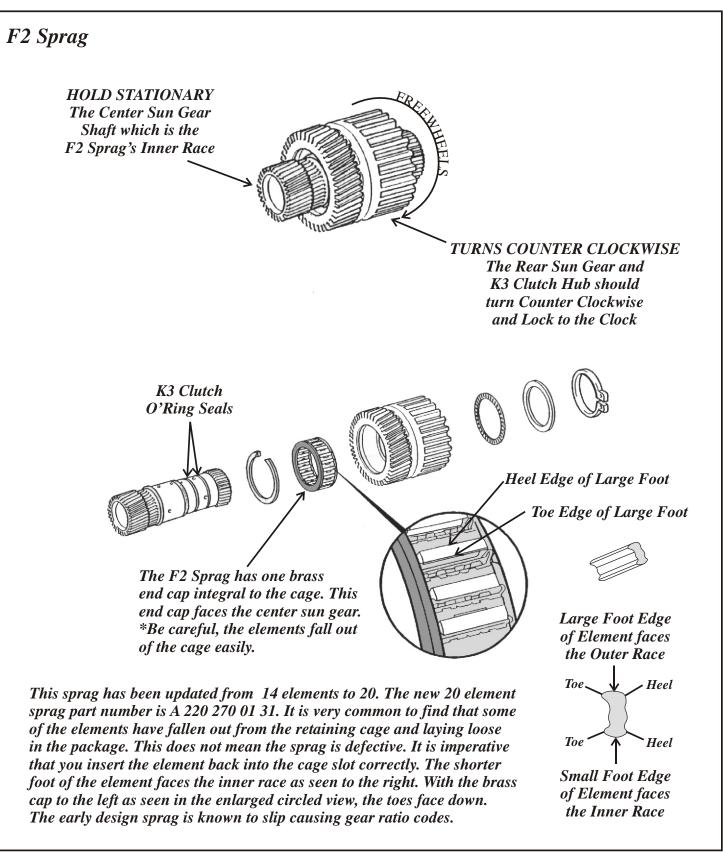


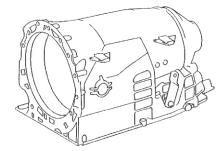
Figure 69





**B3** Clutch

The steel plates in the B3 Clutch are indexed to internal case lugs.



The 3 tab cushion plate sits on the B2 and B3 piston and drum assembly like a bowl.

The B3 clutch stack contains 3, 4 or 5 frictions. Clutch pack clearance specifications are 1.0 to 1.4 mm or .039 to .055 inches.

Clutch clearance is adjusted by the retaining selective snap ring. There are 6 sizes available: 3.1 mm - .124" - A 140 994 15 35 3.4 mm - .135" - A 140 994 16 35 3.7 mm - .147" - A 140 994 17 35 4.0 mm - .157" - A 140 994 41 35 4.3 mm - .169" - A 140 994 42 35 4.6 mm - .181" - A 140 994 43 35

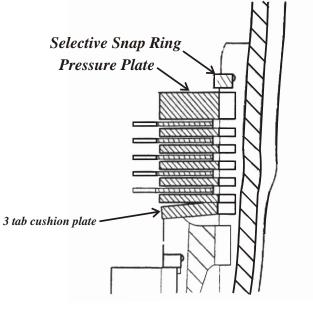
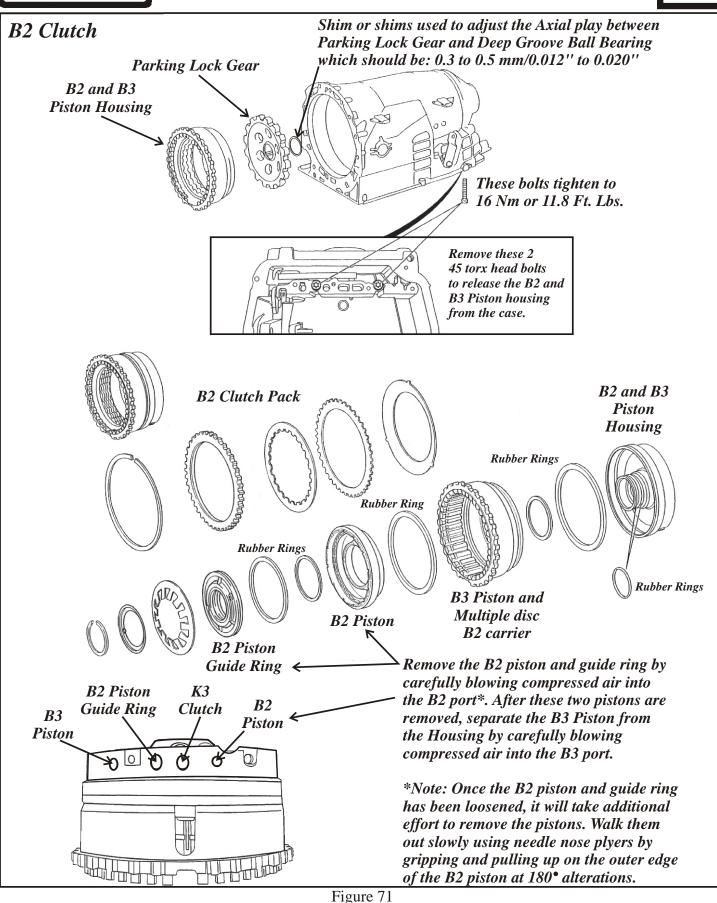


Figure 70





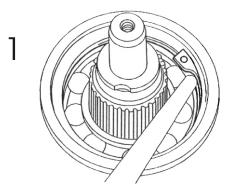


The B2 clutch stack varies with either Selective Snap Ring, 4 or 5 frictions. Clutch pack clearance **Pressure Plate** specifications are 0.2 to 1.3mm or .008 to .051 inches with the 4 friction stack up. The 5 friction stack up is 0.2 to 1.4mm or .008 to .055 inches. See Page 37 *Clutch clearance is adjusted by the retaining* selective snap ring. There are 5 sizes available: 2.8 mm - .110" - A 140 994 63 35 3.1 mm - .122" - A 140 994 62 35 3.4 mm - .134" - A 140 994 61 35 3.7 mm - .146" - A 140 994 60 35 4.0 mm - .158" - A 140 994 59 35 When assembling the B2 and B3 Piston Housing, place the Park/Lock Gear into the bottom of the case first. Then Install the B2 and B3 Piston Housing **B3** Piston and indexing the feed ports and bolt holes to the case. Multiple disc Once installed, install the (2) 45 Torx Head bolts **B2** carrier B2 & 3 Piston illustrated in Figure 71 by hand. Housing (Guide) Case Lube all sealing rings generously and install the B3 Piston/Multiple disc Park/Lock B2 carrier with its open gap to the 6 o'clock Position as shown in the Gear enlarged circled view. Once in place, install the well lubricated B2 Piston followed by the B2 Piston Guide. NOTE: The Piston Guide must have its one-way check valve at the 12 o'clock position as seen in the figure to the right. **B2** Piston Guide must be installed with the one-way check valve at the 12' Oclock B2 Piston \_ position. **B2** Piston Guide with one-wav check valve B3 Piston/Multiple disc B2 carrier **B2** Piston with open gap in the 6 o'clock Position

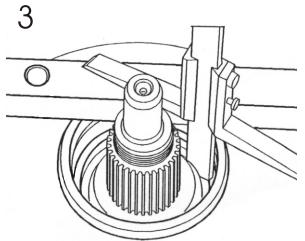
Figure 72



End Play Adjustment

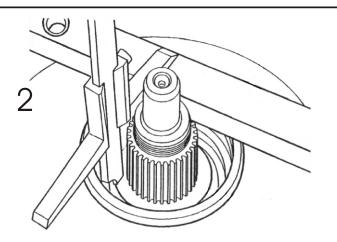


Once the internal transmission components have been installed, remove the output shaft's Ball Bearing support. (It would be easier to remove this bearing while the output shaft is out)

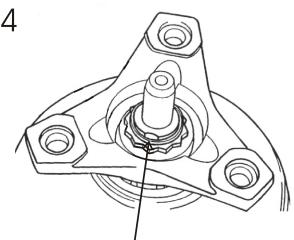


Using a cross bar and depth gauge, measure the distance from the cross bar to the bottom lip of the Ball Bearing Pocket. Adjust the axial play by subtracting step 3's figures from step 2's figures. Example:

Cross bar to Park/Lock Gear 49.90 mm (1.964") MINUS -Cross bar to Bearing Pocket 49.00 mm (1.929") EQUALS = 0.90 mm (0.035")



Using a cross bar and depth gauge, measure the distance from the cross bar to the Park/Lock Gear.



With a 30mm 12 point socket and torque wrench, tighten the collar nut (part number: 1239900060) to 120 Nm/88.5 Ft. Lbs. Using a punch, steak the shoulder of the nut into the key slot of the output shaft.

Since the axial play needs to be between 0.3 to 0.5 mm (0.012 - 0.020"), subtract 0.4 mm (0.016") from the example figure of 0.90mm (0.035"). This equals 0.50 mm (0.019"), the shim thickness needed to provide the axial play of 0.40mm (0.016"). There are 4 thicknesses available: 0.2, 0.3, 0.4 and 0.5mm (0.008, 0.012, 0.016 and 0.020"). The shim is installed on top of the Park/Lock Gear, then the Ball Bearing and snap ring can be installed.

Figure 73



40

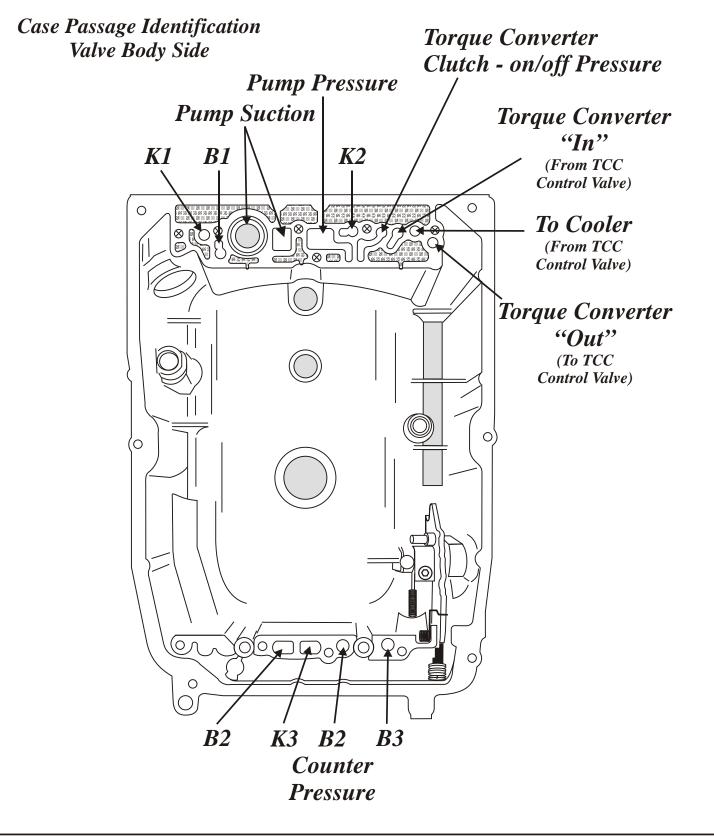


Figure 74





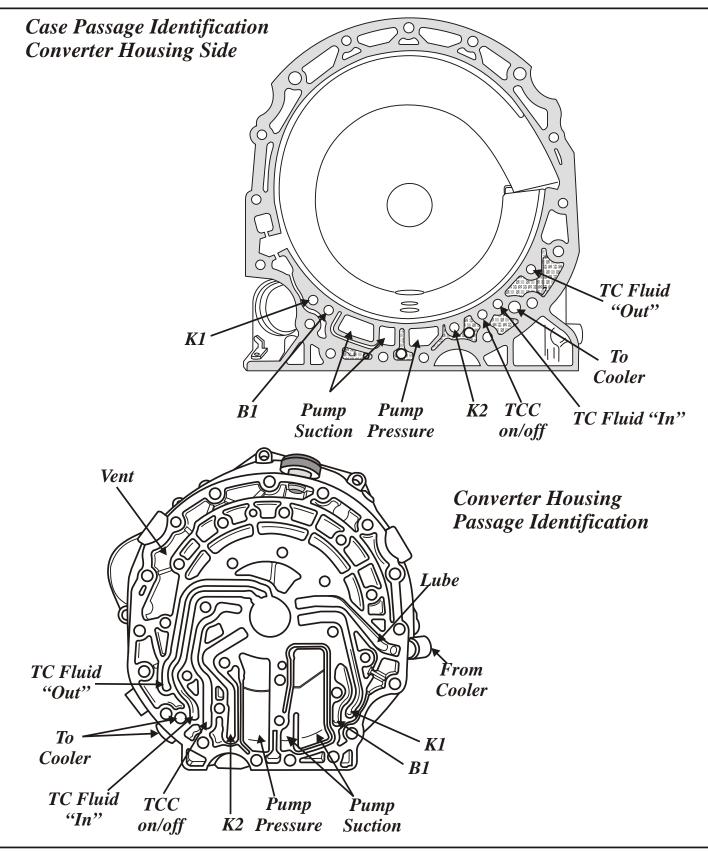


Figure 75



### **DIAGNOSING THE 722.6 TRANSMISSION**

#### HOWZETWERKS

This computer controlled transmission is composed of a lock up torque converter, a valve body, 3 holding clutches, 3 driving clutches, 2 sprags, 3 shift solenoids, 2 pressure control solenoids and 1 converter clutch solenoid through which the computer can command 5 speeds forward and two available ratios for reverse.

Hydraulically there are 8 basic pressure levels within this transmission's hydraulic system. Unfortunately there are no pressure taps available for any one of these pressure circuits removing any ability to test them. The technician is now challenged to diagnose without a pressure gauge. At best the only diagnostic tool available to a technician is a scanner. This will be helpful but as a stand alone diagnostic tool, it will be limited in diagnosing and pin pointing pressure losses within the transmission. What will be needed to enhance scanner information is an overall understanding of the mechanical, hydraulic ane electrical operation of the transmission. This overall knowledge combined with scanner information can then be compared to the symptom malfunction observed with the transmission when driving the vehicle. By doing so, a technician's ability to diagnose the problem may come closer to hitting the mark of the bulls eye instead of missing the board all together.

### THE MECHANICAL OPERATION

Many technicians who understand planetary operation will find the DaimlerChrysler 722.6 transmission, sporting 3 planetary gear sets in which to achieve 5 forward gear ratios and 2 ratios for reverse, fascinating. Usually, within a typical automatic transmission, there is a forward clutch drum attached to an input shaft. When the forward clutch applies, it clamps onto an internal ring which becomes the driving forward force within the planetary assembly. So one could easily think that the K2 clutch would be that driving force for the forward gears in the 722.6 transmission after all, the input shaft is an integral part of the drum (See Figure 76). But one look at the clutch application chart in Figure 77 and you find that the K2 clutch is not at all applied for 1st gear take off. So what's the deal? With a closer look in Figure 76, you can see that the front internal ring gear is also an integral part of the input shaft and K2 clutch drum. The input shaft receives its power from the engine through the torque converter which then drives the K2 drum and internal ring gear. The K2 clutch doesn't need to be applied to get the power into the planetary gear set for a first gear take off as the internal ring gear is part of the drum. The clutches that are on; the B1, B2 and K3, hold stationary all three sun gears within each of the planetary gear sets and prevents freewheeling of the F1 and F2 sprags (See Figure 78). This completes the first gear ratio through the planetary system and out to the rear wheels.

This is interesting because in a transmission training course 101, you learn that with a simple planetary system, in order to acquire a reduction, the sun gear is held, the ring gear is driven and the planetary pinions force the carrier to rotate in a reduction. And that is exactly what is happening with each and every planetary set in the 722.6 transmission. All 3 planets are operating in a reduction to make first gear which in diesels, 4 and 6 cylinder engines is a 3.932:1 ratio while in 8 and 12 cylinder engines it is a 3:59:1 ratio.

*Special Note:* The ratio difference between the two is based on the number of gear teeth in the planetary system. These different ratios are not interchangeable. The proper planetaries must be used according to engine size and vehicle application or the computer will fails afe this vehicle.

To achieve the next highest ratio called 2nd gear, the B1 clutch releases and the K1 clutch is applied. This action locks only the front planetary gear set to a 1:1 ratio while the center and rear planetary sets remain in a state of reduction (See Figure 79). The ratio for second gear is either 2.408 or 2.19 to 1.

The next up shift into a gear called 3rd consists of releasing the K3 clutch and applying the K2 clutch (See Figure 80). This action locks the rear planetary set to a 1:1 ratio allowing only the center planetary gear set to operate in a reduction. The ratio for 3rd gear is either 1.486 or 1.41 to 1.





### **DIAGNOSING THE 722.6 TRANSMISSION**

With the 4th gear shift, the B2 clutch releases and the K3 clutch applies (See Figure 81). This now locks the center planetary set to a 1:1 ratio. All three planetaries are now rotating in a 1:1 ratio making 4th gear direct drive for any engine size.

When the overdrive shift into 5th gear occurs, the K1 clutch releases an the B1 clutch applies as seen in Figure 82. This is where it gets mind boggling. The front planetary assembly goes into a reduction which drives the rear internal ring gear at this same reductive speed. Meanwhile the K2 clutch is driving the center internal ring gear and rear carrier at input speed. This combination drives the rear sun gear at a higher speed ratio. With the K3 clutch on, the rear sun gear is connected to the center sun gear which drives the center carrier which is connected to the output shaft is then driven by the sun gears to an overdrive ratio of 0.83.

When it comes to reverse, there are two options available for the driver; a Standard mode and a Winter mode. With the Standard "S" mode selected, reverse has a 3.16 ratio. In the Winter "W" mode, a 1.93 ratio is available and for obvious reasons. This higher ratio will help prevent "Tire Breakaway" from take off on slippery surfaces. So howduzetwerk? Basically what happens here is that with the B1 clutch on, the front planetary assembly drives the rear internal ring gear at a reduction in the Standard mode (See Figure 83). In the Winter mode, the K1 clutch is on and the front planetary assembly locks to a 1:1 ratio driving the rear internal ring gear at a higher ratio than when the planetary was in reduction (See Figure 84). The B3 and K3 clutch are the key components to make the reversal take place in the rear to center planetaries and out the output shaft.

I am sure that if you had read this far into the article, you are definitely interested in wanting to know Howzetwerks. It does take some concentration to understand this planetary power flow, but I have got to say, I would like to meet the person who designed it. What a genuine gear head!



Figure 76



5	F2	×	×							
	F1	Х				Х <sup>3</sup>		Х		
B R	K3	Х <sup>3</sup>	Х <sup>3</sup>		Х	X	Х	Х	×	
E E E E E	K2			X	Х	X				eaking
2	K1		Х	X	Х				×	ition sition igine bre
	B3							×	×	"S" Pos "W" Pos èd for en
	B2	×	X	×						ch in the "S" Position ch in the "W" Position re required for engine nditions
	B1	Х <sup>3</sup>				Х	Х	Х <sup>3</sup>		or Switcl or Switcl nents are
	RATIO	3.59	2.19	1.41	1.00	0.83		-3.16	-1.93	<ol> <li>Mode Selector Switch in the "S" Position</li> <li>Mode Selector Switch in the "W" Position</li> <li>Shift components are required for engine breaking during coasting conditions</li> </ol>
	GEAR	1	2	3	4	5	Z	R1	$\mathbb{R}^2$	1 - Mc 3 - Mc dt

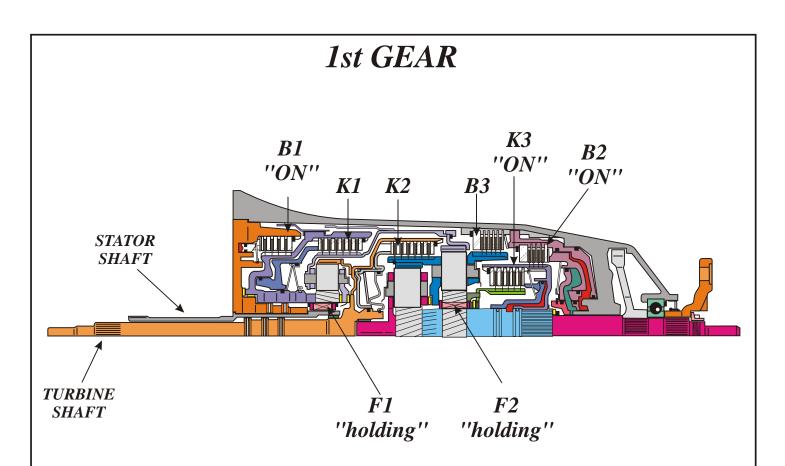
Figure 77

Automatic Transmission Service Group









Expanded Summary: The turbine shaft drives the front planetary ring gear. The B1 brake is on to lock the K1 drum which is connected to the front planetary assembly's sun gear (which prevents the F1 freewheel from overrunning). This forces the front planetary pinions to rotate around the held front sun gear. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier), which in-turn forces the rear planetary pinions to rotate around the held rear planetary sun gear. The rear planetary carrier is connected to the center planetary's ring gear, which in-turn drives the output shaft (which is the center planetary's carrier) around the held center planetary sun gear. The B2 brake is on which locks the K3 drum, which is connected to the center planetary sun gear. The K3 drum is on which locks the rear planetary sun gear, which is the outer race for the F2 freewheel. This prevents the F2 freewheel from overrunning.

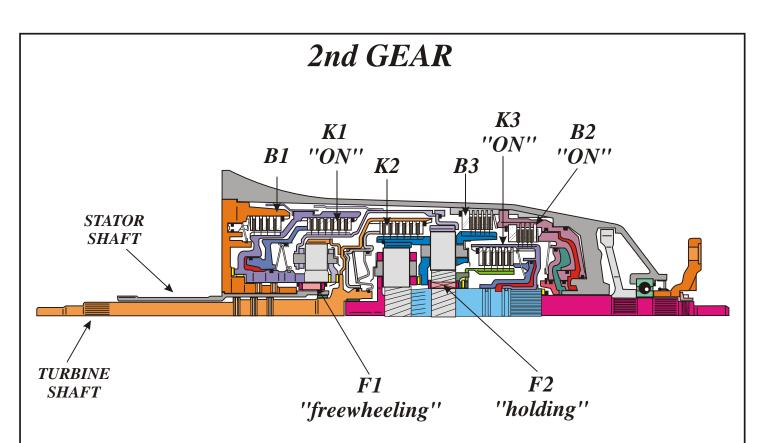
# SIMPLIFIED

3 RING GEARS DRIVING 3 CARRIERS AROUND 3 STATIONARY SUN GEARS

Figure 78







Expanded Summary: The turbine shaft drives the front planetary ring gear. The B1 brake is turned off and the K1 clutch, which is connected to the front planetary carrier, is turned on. This forces the front planetary assembly to rotate at a 1:1 ratio. The F1 freewheels as a result of the sun gear (which is connected to the K1 clutch) rotating with the complete front planetary assembly. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier), which in turn forces the rear planetary pinions to rotate around the held rear planetary sun gear. The rear planetary carrier is connected to the center planetary ring gear, which in-turn drives the output shaft (which is the center planetary's carrier) around the held center planetary sun gear. The B2 brake is on which locks the K3 drum, which is connected to the center planetary sun gear. The K3 drum is on which locks the rear planetary sun gear, which is the outer race for the F2 freewheel. This prevents the F2 freewheel from overrunning.

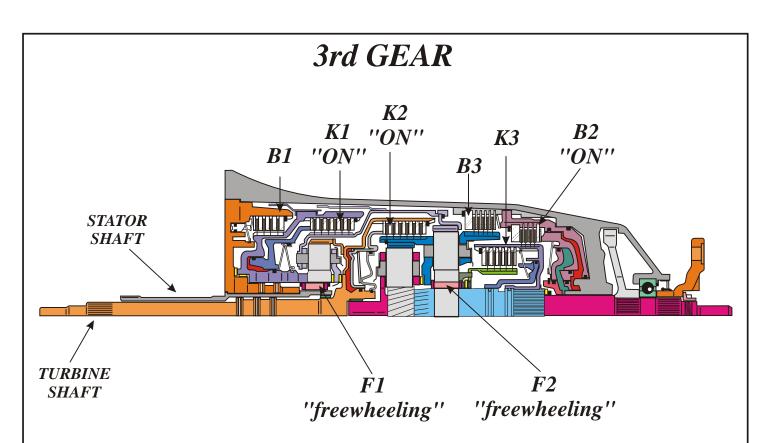
# SIMPLIFIED

FRONT PLANETARY (locked) 1:1 DRIVING THE CENTER AND REAR RING GEARS THRU THE CENTER AND REAR CARRIERS AROUND THE CENTER AND REAR STATIONARY SUN GEARS

Figure 79







Expanded Summary: The turbine shaft drives the front planetary ring gear. The K1 clutch, which is connected to the front planetary carrier, is on. This forces the front planetary assembly to rotate at a 1:1 ratio. The F1 freewheels as a result of the sun gear (which is connected to the K1 clutch) rotating with the complete front planetary assembly. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier). The K2 clutch, which is connected to the rear carrier, is turned on and forces the rear planetary assembly to rotate at a 1:1 ratio. The F2 freewheels as a result of the sun gear (which is connected to the K3 clutch hub) rotating with the complete rear planetary assembly. The rear planetary assembly to rotate at a 1:1 ratio. The F2 freewheels as a result of the sun gear (which is connected to the K3 clutch hub) rotating with the complete rear planetary assembly. The rear planetary carrier is connected to the center planetary ring gear, which in turn drives the output shaft (which is the center planetary's carrier) around the held center planetary sun gear. The B2 brake is on which locks the K3 drum, which is connected to the center planetary sun gear.

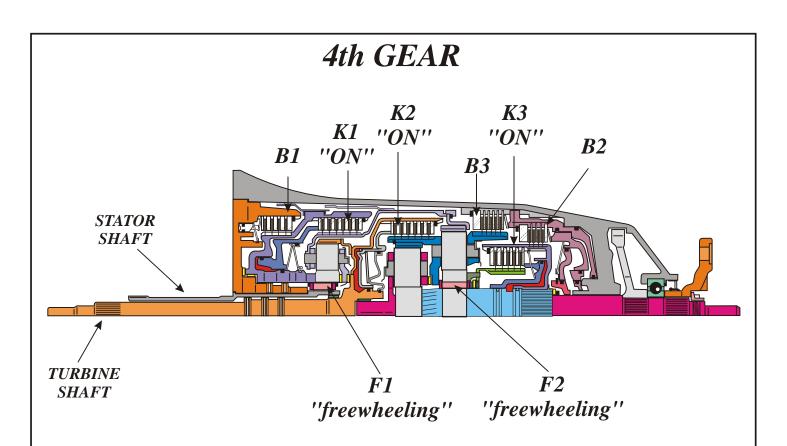
# SIMPLIFIED

FRONT PLANETARY (locked) 1:1 REAR PLANETARY (locked) 1:1 DRIVING THE CENTER RING GEAR AND CARRIER AROUND THE CENTER STATIONARY SUN GEAR

Figure 80







Summary: The turbine shaft drives the front planetary ring gear. The K1 clutch, which is connected to the front planetary carrier, is on. This forces the front planetary assembly to rotate at a 1:1 ratio. The F1 freewheels as a result of the sun gear (which is connected to the K1 clutch) rotating with the complete front planetary assembly. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier). The K2 clutch, which is connected to the rear carrier, is turned on and forces the rear planetary assembly to rotate at a 1:1 ratio. The B2 brake is turned off and the K3 clutch , which is connected to the center planetary's sun gear, is turned on. This forces the center planetary assembly to rotate at a 1:1 ratio.

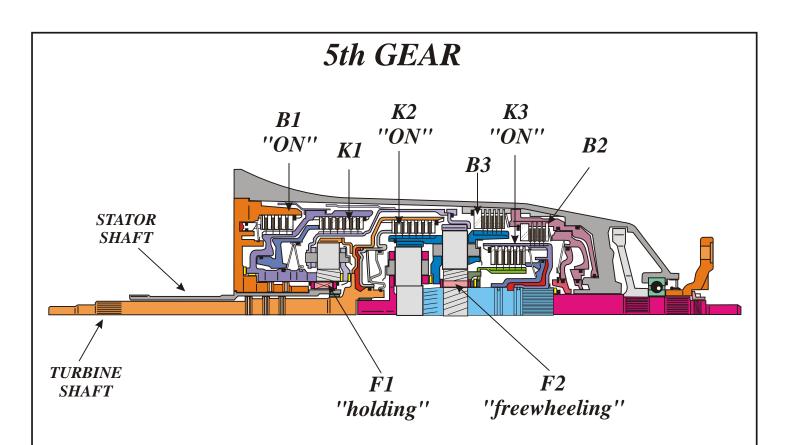
# SIMPLIFIED

FRONT PLANETARY (locked) 1:1 CENTER PLANETARY (locked) 1:1 REAR PLANETARY (locked) 1:1

Figure 81







Expanded Summary: The turbine shaft drives the front planetary ring gear. The K1 clutch is turned off and the B1 brake is turned on. This locks the K1 drum, which is connected to the front planetary assembly's sun gear (this prevents the F1 freewheel from overrunning). This forces the front planetary carrier to rotate around the held front sun gear. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier). The K2 clutch, which is connected to the rear carrier, is on. The K3 clutch, which is connected to the rear planetary sun gear, is on. This forces the center planetary assembly to rotate the output shaft in an overdrive ratio.

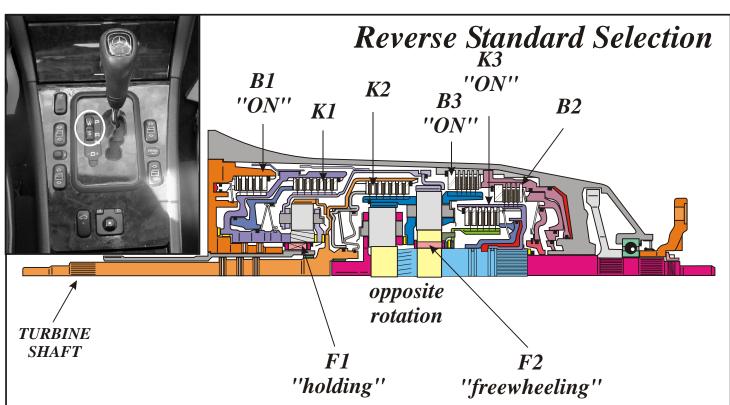
# SIMPLIFIED

FRONT PLANETARY ASSY. IN REDUCTION DRIVING THE REAR INTERNAL RING GEAR IN REDUCTION REAR CARRIER DRIVEN AT INPUT SPEED REAR AND CENTER SUN GEAR DRIVING CENTER CARRIER IN OVERDRIVE

Figure 82







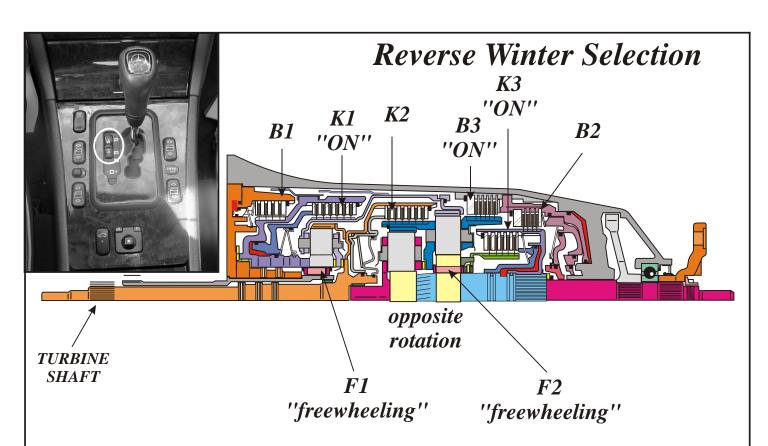
Summary: The turbine shaft drives the front planetary ring gear. The B1 brake is turned on. This locks the K1 drum, which is connected to the front planetary assembly's sun gear (which prevents the F1 freewheel from overrunning). This forces the front planetary carrier to rotate around the held front sun gear. The B3 brake is on to lock the rear carrier and center planetary ring gear. The K3 clutch is on which locks the rear and center planetary sun gears. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier), which forces the rear planetary sun gear to turn in the opposite rotation of the engine. Now the center planetary sun gear can drive the center planetary carrier, which is the output shaft, at a reduced speed opposite of engine rotation.

# SIMPLIFIED

FRONT PLANETARY ASSEMBLY IN REDUCTION REAR AND CENTER SUN GEARS DRIVING CENTER CARRIER AND OUTPUT SHAFT IN A REVERSAL

Figure 83





Summary: The turbine shaft drives the front planetary ring gear. The K1 clutch, which is connected to the front planetary carrier, is on. This forces the front planetary assembly to rotate at a 1:1 ratio. The F1 freewheels as a result of the sun gear, (which is connected to the K1 clutch), rotating with the complete front planetary assembly. The B3 brake is on to lock the rear carrier and center planetary ring gear. The K3 clutch is on which locks the rear and center planetary 's sun gears. The front planetary ring gear is linked to the rear planetary ring gear, (thru the rotating front planetary carrier), which forces the rear planetary's sun gear to turn in the opposite rotation of the engine. Now the center planetary's sun gear can drive the center planetary carrier, which is the output shaft, opposite of engine rotation.

# SIMPLIFIED

FRONT PLANETARY ASSEMBLY LOCKED 1:1 REAR AND CENTER SUN GEARS DRIVING CENTER CARRIER AND OUTPUT SHAFT IN A REVERSAL

Figure 84



### **DIAGNOSING THE 722.6 TRANSMISSION**

#### HYDRAULICS

As previously stated, there are 8 basic pressure levels within this transmission's hydraulic system without any pressure taps to test them. These pressure levels are as follows:

PRESSURE CIRCUITS	PRESSURE VALUES				
Line Pressure	60-320 psi				
Modulating Pressure	0-125 psi				
Regulated Shift Pressure	0-120 psi				
Shift Pressure	0-220 psi				
Solenoid Shift "In" Pressure	50-55 psi				
Line Pressure Solenoid "In" Pressure	120-125 psi				
Torque Converter Pressure	0-100 psi				
TCC Apply Pressure	0-118 psi				

To fully appreciate and understand the hydraulic operation of this unit, it is necessary to understand the operation of each of the solenoids and the valves in the valve body that they influence.

#### SHIFT SOLENOIDS

There are three shift solenoids, the 1-2/4-5 (Y3/6y3), the 2-3 (Y3/6y5) and the 3-4 (Y3/6y4). Just by their very names you can determine their functions. Obviously the 1-2/4-5 solenoid is responsible for the 1-2 and 4-5 upshift as well as their respective downshifts. Then of course you have the 2-3 solenoid for the 2-3 and 3-2 shift while the 3-4 solenoid handles the 3-4 and 4-3 shift. Each of these 3 solenoids are fed with 50 to 55 psi of pressure called "Solenoid Shift Pressure" which is controlled by the Shift Solenoid "In" Pressure Valve.

#### PRESSURE SOLENOIDS

There are two pressure control solenoids. One is called the Modulating Pressure Regulating Solenoid (Y3/6y1) and the other is the Shift Pressure Regulating Solenoid (Y3/6y2).

The Modulating PR Solenoid regulates pressure between 0 to 125 psi which influences the Pressure Regulator Valve to increase main line pressure (Working Pressure) from a static 60 psi to as high as 320 psi depending upon torque input. This Modulating PR Solenoid oil also influences the 1-2/4-5, 2-3 and 3-4 shift overlap valves so that the shift overlap of a releasing and applying clutch corresponds to torque input.

The Shift Pressure Solenoid regulates pressure between 0 to 120 psi which influences the Shift Pressure Regulator Valve for a controlled clutch apply pressure (Shift Pressure) during a shift transition only. This transitional clutch apply pressure (Shift Pressure) starts from a low 0 psi to as high as 220 psi depending upon torque input.

Both of these solenoids are fed with a maximum of 125 psi from the Line Pressure Solenoid "In" Pressure Valve.





### **DIAGNOSING THE 722.6 TRANSMISSION**

#### SOLENOID SHIFT CHART

From the solenoid shift chart below, you will notice that shift solenoids 1-2/4-5, 2-3 and 3-4 are toggled "on-tooff" to make there respective shifts. While in gear they remain in the "off" state. This explains how while driving, whatever the gear the transmission was in at the time the computer system observed a fault, that would be the gear the transmission failsafes to. When the vehicle is brought to a stop and the ignition is cycled, the transmission will remain in second gear. *Special Note:* If codes are stored and repairs have been made, all codes must be cleared for the limp mode feature to be turned off.

GEAR	SOLENOID								
SHIFTS	1-2/4-5 👗	2-3	3-4★	MOD $PC^{H}$	SHIFT PC <sup>©</sup>				
FIRST	OFF	OFF	OFF	PWM	OFF				
SHIFT	ON	OFF	OFF	PWM	PWM				
SECOND	OFF	OFF	OFF	PWM	OFF				
SHIFT	OFF	ON	OFF	PWM	PWM				
THIRD	OFF	OFF	OFF	PWM	OFF				
SHIFT	OFF	OFF	ON	PWM	PWM				
FOURTH	OFF	OFF	OFF	PWM	OFF				
SHIFT	ON	OFF	OFF	PWM	PWM				
FIFTH	OFF	OFF	OFF	PWM	OFF				

Additional solenoid activity not shown:

▲ 1-/4-5 Solenoid is pulsed during ignition crank.

3-4 Shift solenoid is pulsed continuously while in Park and during selector lever movement (Garage Shifts).

- a) Pulsed constantly while idling in Park or Neutral at approximately 40% Duty cycle.
  - b) Voltage observed varied with throttle opening as well as during selector lever movement.
- a) Pulsed constantly while idling in Park or Neutral at approximately 33% Duty cycle.b) Voltage observed varied with throttle opening during each gear shift only.

NOTE" The TCC solenoid is not listed here but is pulsed to apply the converter clutch

#### SHIFT GROUPS

By viewing the mechanical, hydraulic and electrical operation of a shift, it can be observed that a specific solenoid and a group of valves cause a clutch application change. This is described as a "Shift Group." A shift group has two phases. The transition from one gear to the next is called a "shift phase." Once the shift is complete and the transmission is in gear it is called the "stationary phase." There are a total of three shift groups with which 5 forward speeds are achieved. In a shift phase, a shift solenoid initiates the application of one group of valves to change the clutches required for that shift. During this time the other two groups remain in the stationary phase.

A listing of each shift group is provided on the following page.





### **DIAGNOSING THE 722.6 TRANSMISSION**

#### Shift Group K1/B1 (Gear Changes 1-2/4-5)

This group controls the upshift and downshifts 1-2/2-1 and the 4-5,5-4.

K1 Clutch

- B1 Brake
- 1-2/4-5 Command Valve
- 1-2/4-5 Holding Pressure Shift Valve
- 1-2/4-5 Shift Pressure Shift Valve
- 1-2/4-5 Overlap Valve
- 1-2/4-5 Shift Solenoid (Y3/6y3)

#### Shift Group K2/K3 (Gear Change 2-3)

This group controls the upshift and downshift 2-3/3-2.

K2 Clutch

- 3 Clutch
- 2-3 Command Valve
- 2-3 Holding Pressure Shift Valve
- 2-3 Shift Pressure Shift Valve
- 2-3 Overlap Valve
- 2-3 Shift Solenoid (Y3/6y5)

#### Shift Group K3/B2 (Gear Change 3-4)

This group controls the upshift and downshift 3-4/4-3.

K3 Clutch

- B2 Brake
- 3-4 Command Valve
- 3-4 Holding Pressure Shift Valve
- 3-4 Shift Pressure Shift Valve
- 3-4 Overlap Valve
- 3-4 Shift Solenoid (Y3/6y4)

#### GARAGE SHIFT

Another interesting aspect of this transmission is the way in which a smooth garage shift into drive is accomplished. The B2 clutch has a double piston as you can see in Figure 85. Notice how in Figure 86 that as the selector lever moves from Neutral into Drive, the MV 3-4 solenoid (Y3/6y4) duty cycles which pegs the B2 Shift Valve to the end of the bore. This allows the fluid pressure which fills the apply side of the B2 piston to also fill between the apply and counter pistons. This counter pressure opposing apply pressure reduces the apply force of the piston onto the B2 clutches. Once the selector lever has rested in the Drive position (See Figure 97), the MV 3-4 solenoid shuts off. This now allows the B2 shift valve to go into regulation (*The B2 shift valve can act as a regulating valve with the absence of MV 3-4 solenoid oil due to the difference in the valve's land diameters and the metered one-way air bleed capsule in the B2 counter piston).* This brings the counter pressure circuit down to about 0.5 bars or 7.25 psi while allowing full pressure to act on the B2 apply piston for a firm hold on take off.





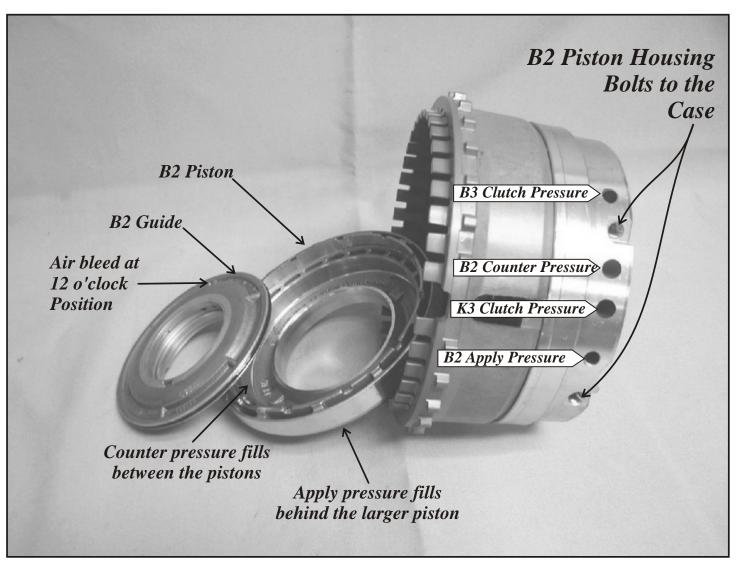


Figure 85





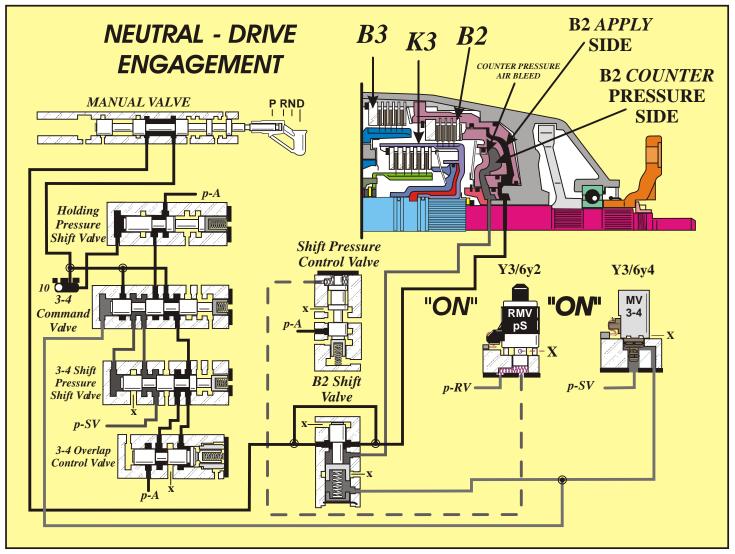


Figure 86





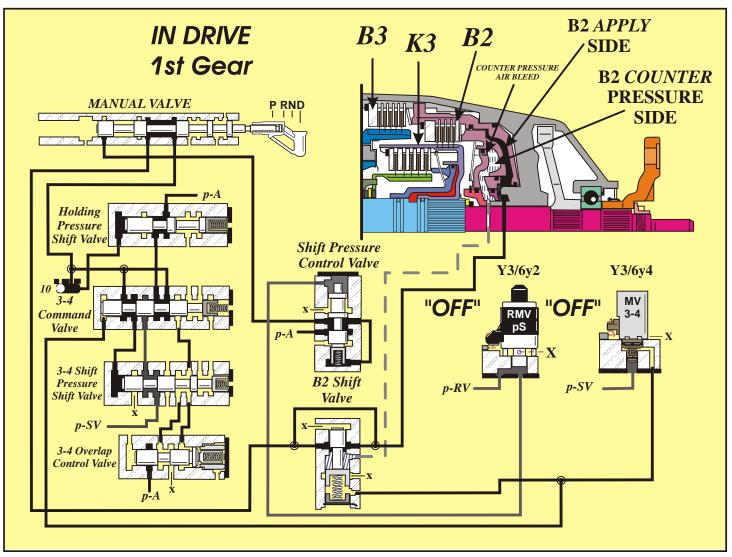


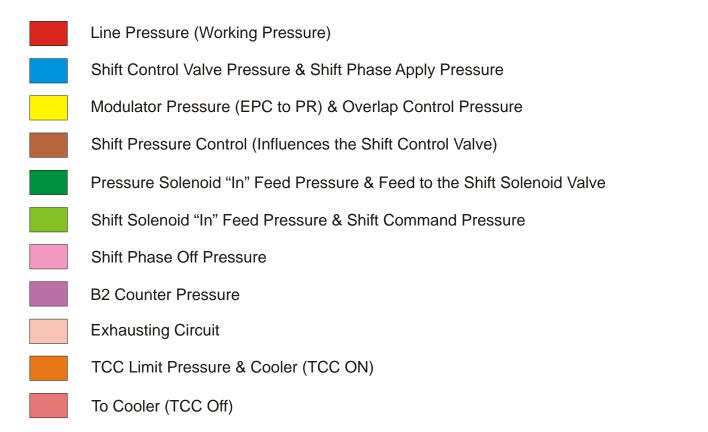
Figure 87





### **DIAGNOSING THE 722.6 TRANSMISSION**

#### HYDRAULIC LEGEND



### CHECK BALL IDENTIFICATION

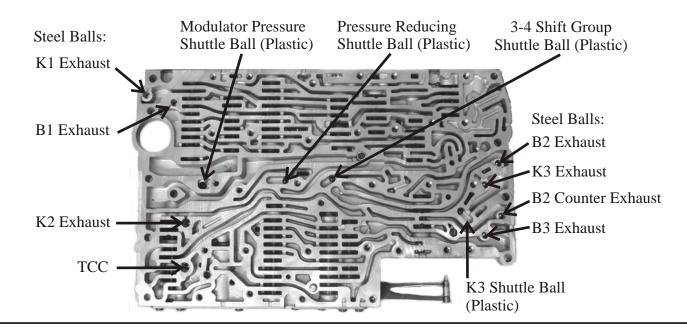
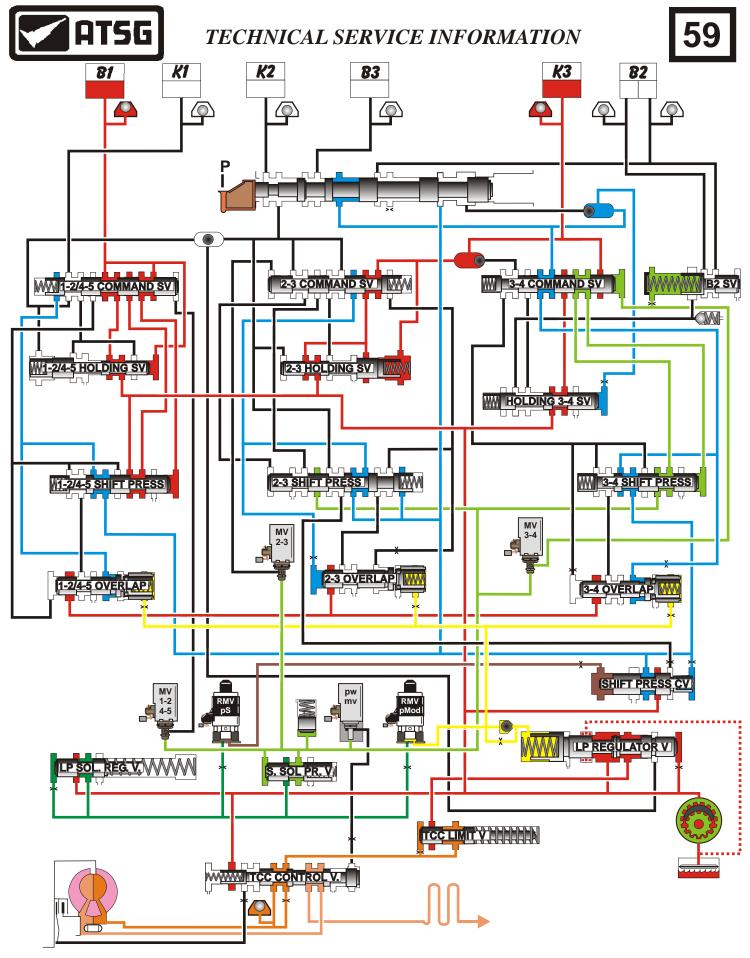
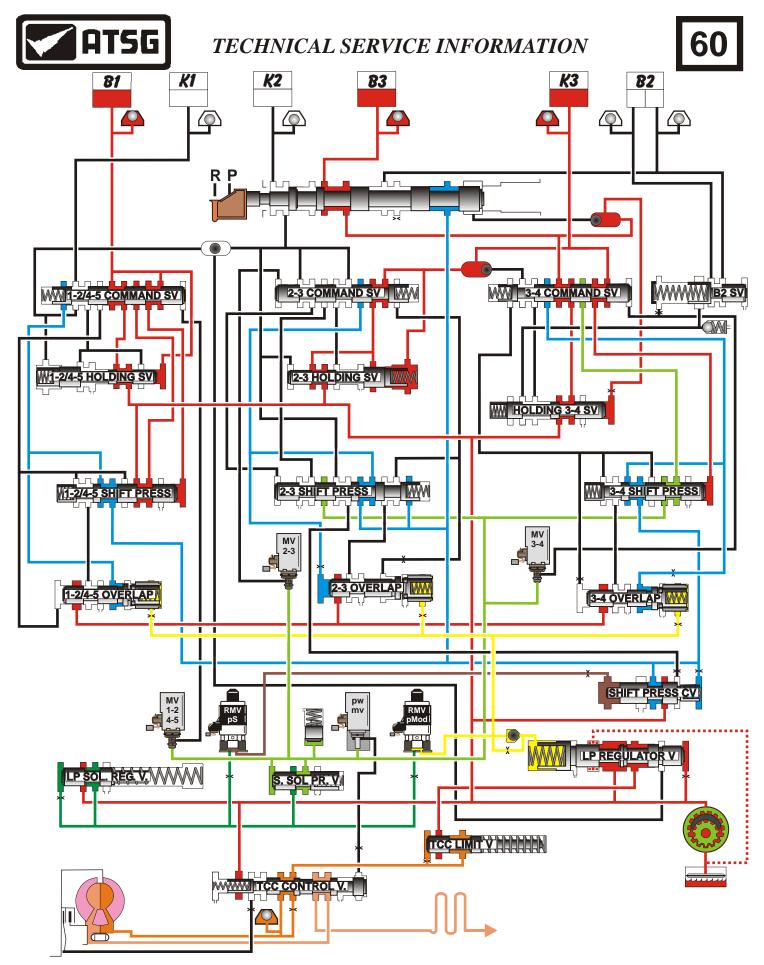


Figure 88 Automatic Transmission Service Group

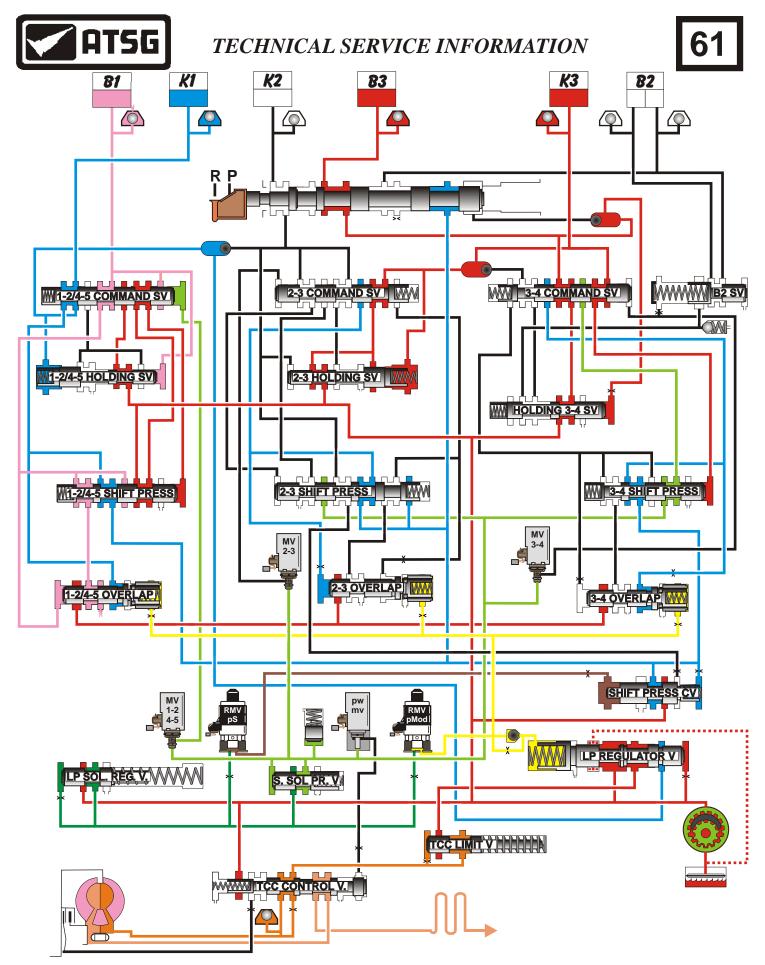


PARK

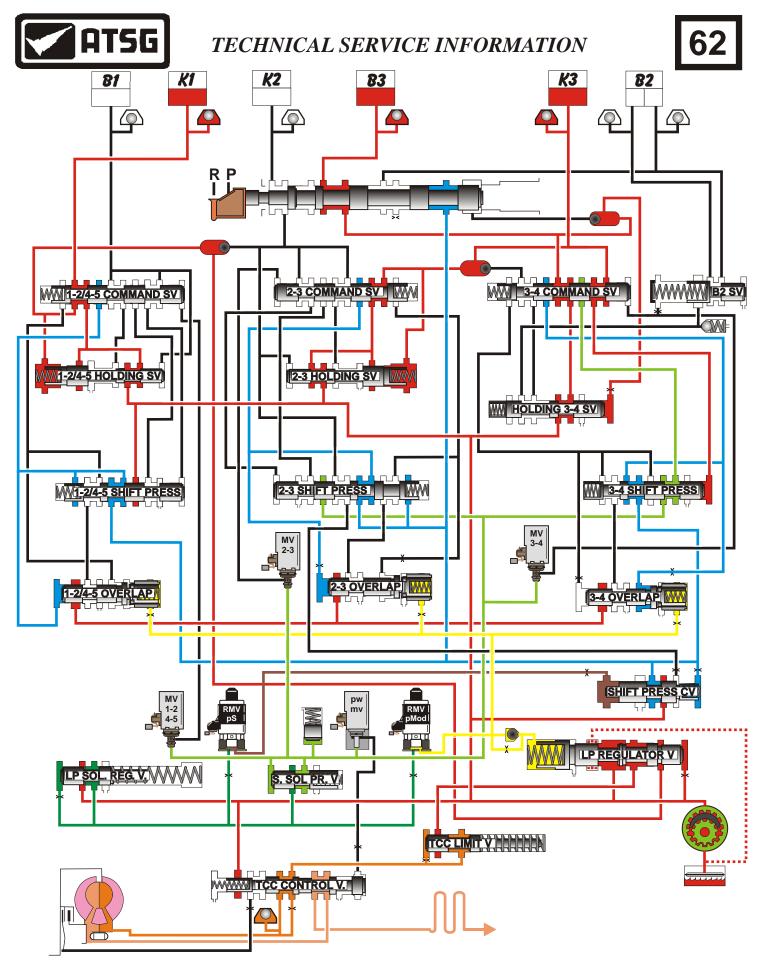
Automatic Transmission Service Group



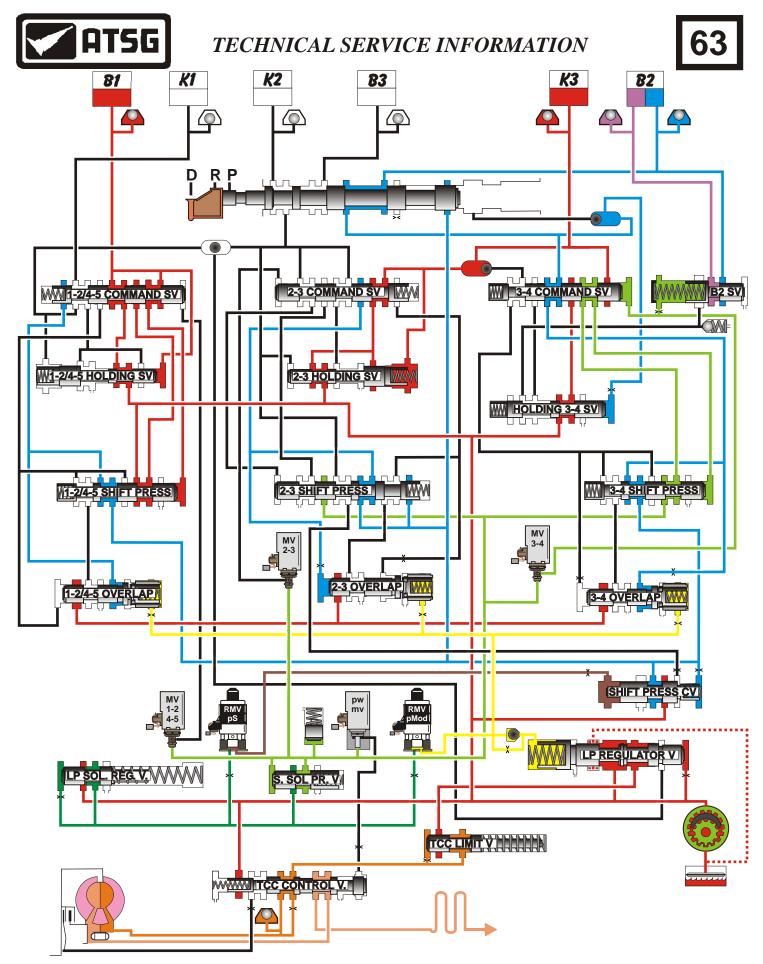
REVERSE - NORMAL/STANDARD MODE



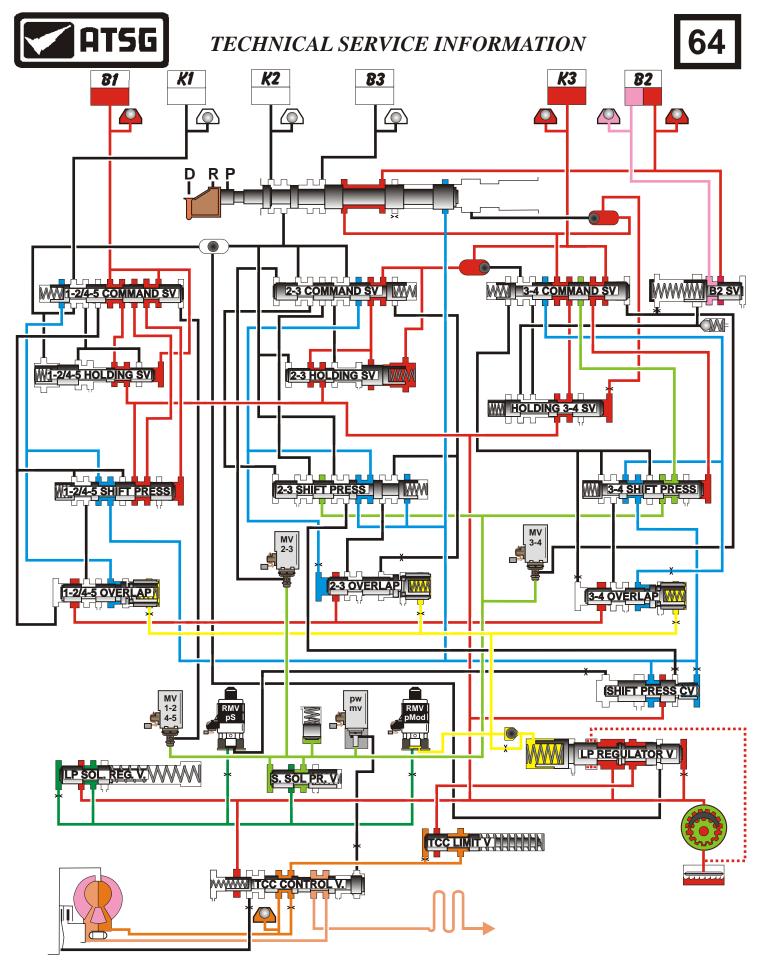
TRANSITION INTO REVERSE - WINTER MODE



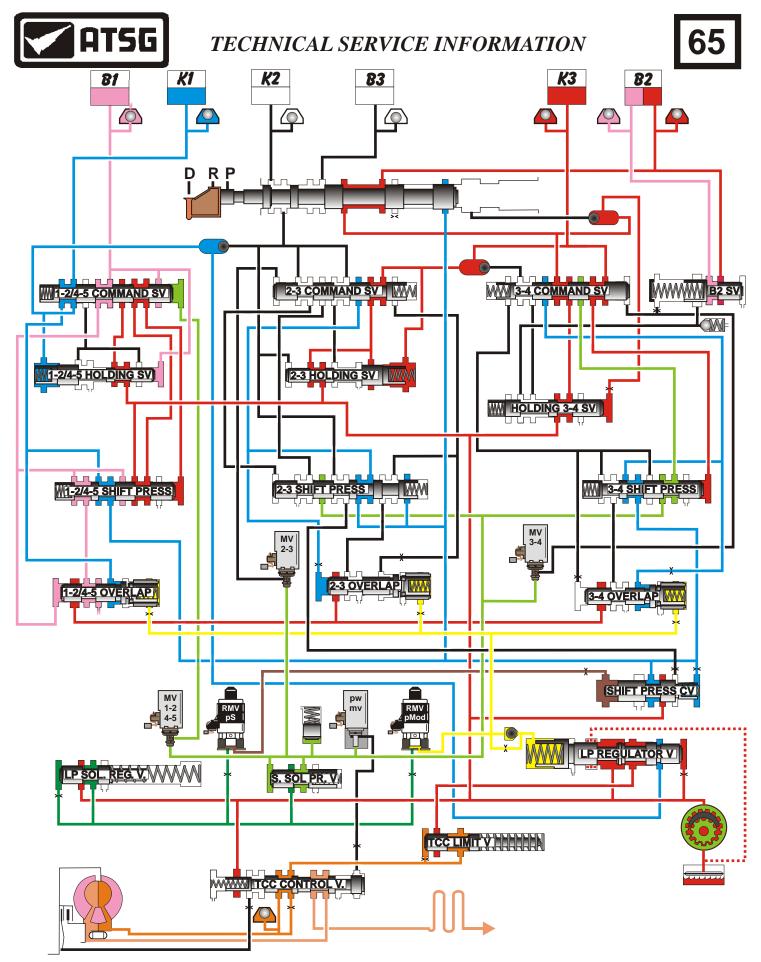
**REVERSE - WINTER MODE** 



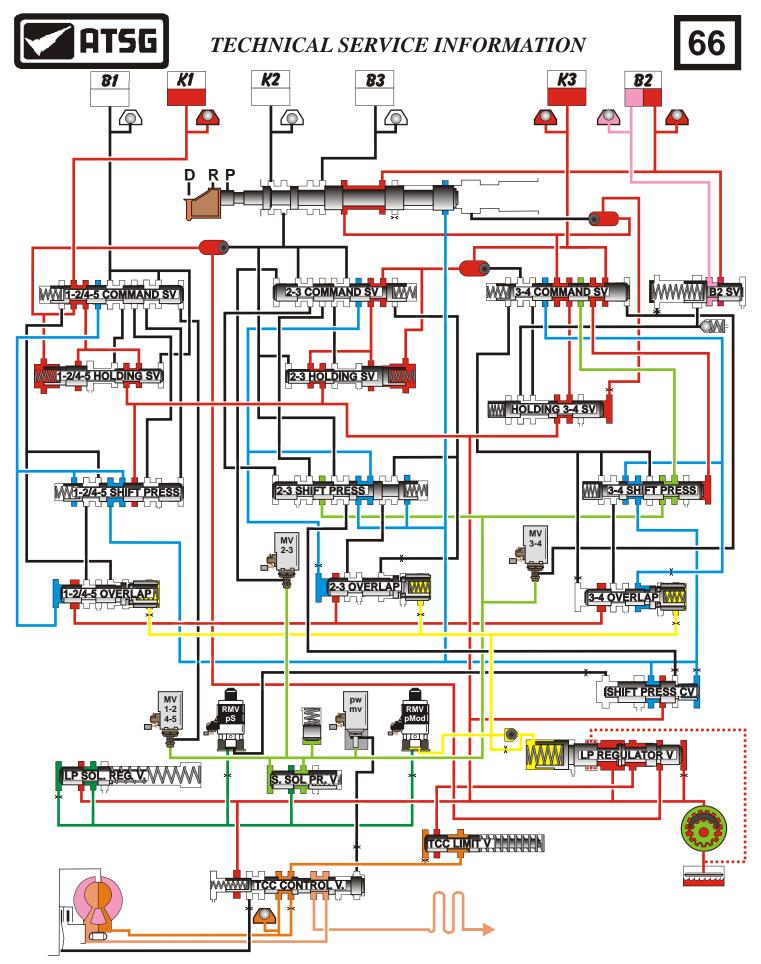
SHIFT TRANSITION INTO DRIVE



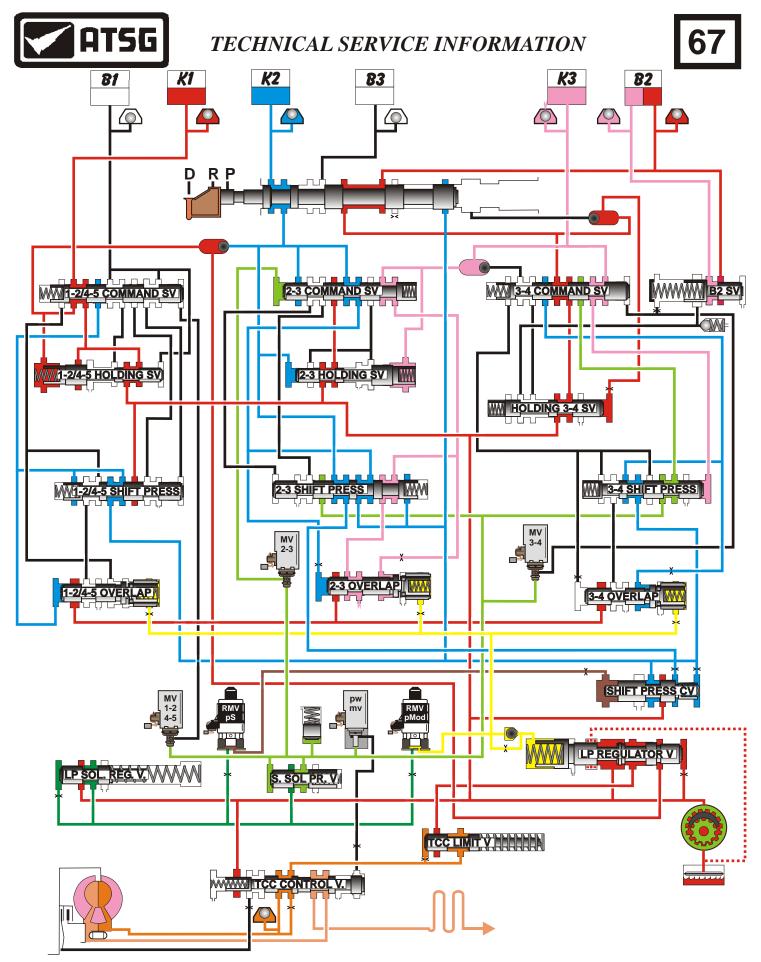
DRIVE FIRST GEAR



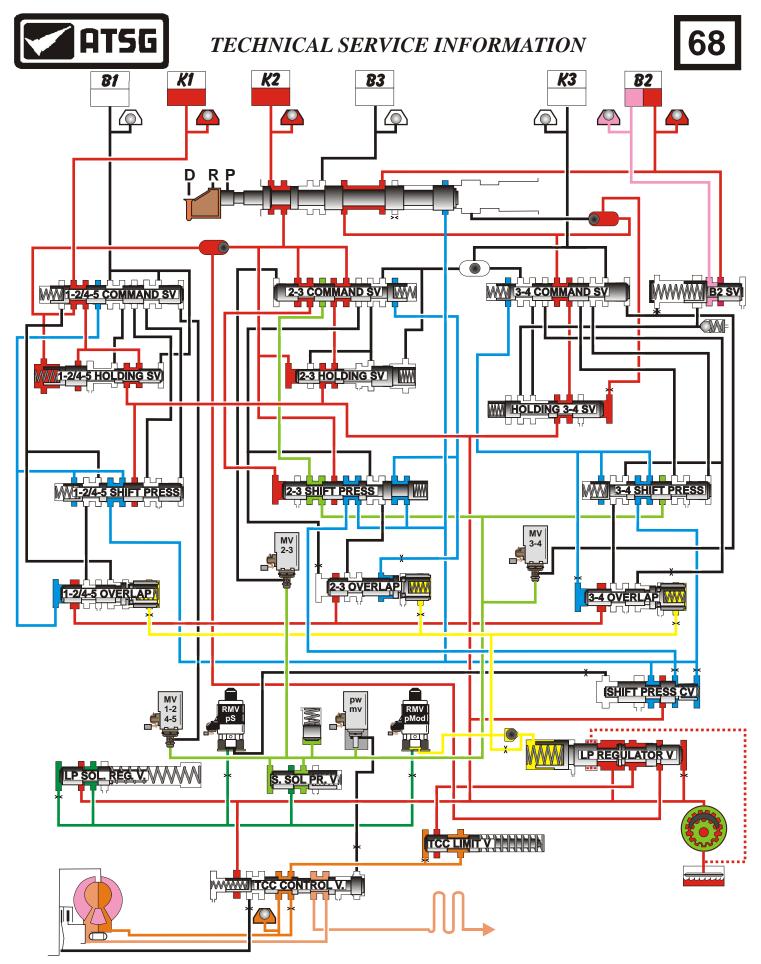
TRANSITION INTO SECOND GEAR



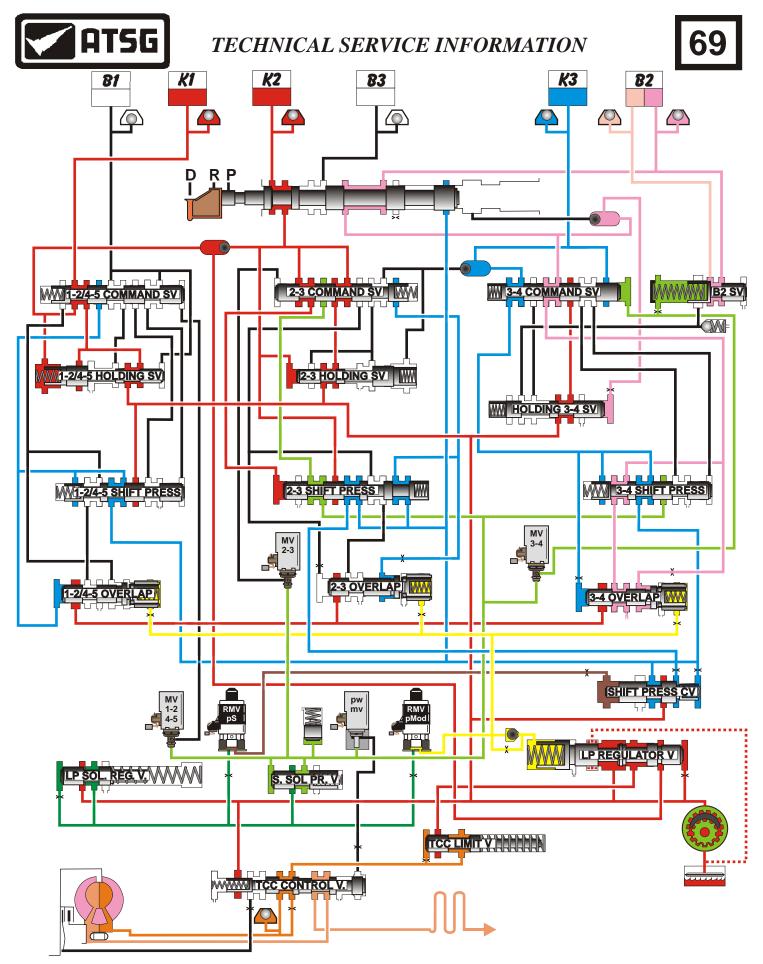
DRIVE SECOND GEAR



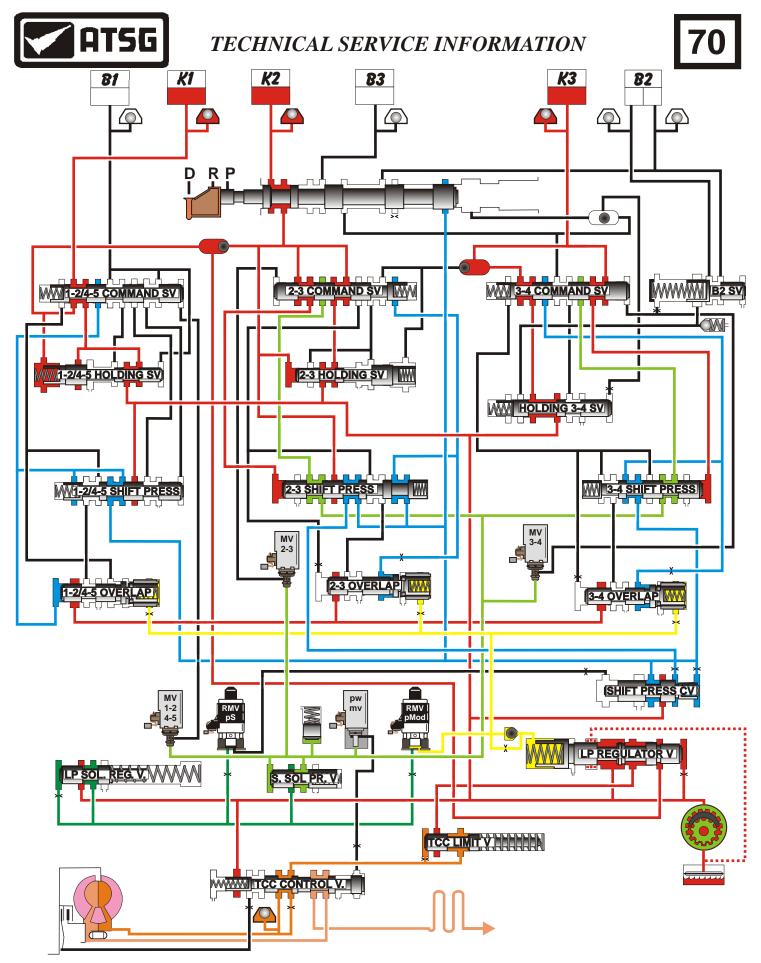
TRANSITION INTO THIRD GEAR



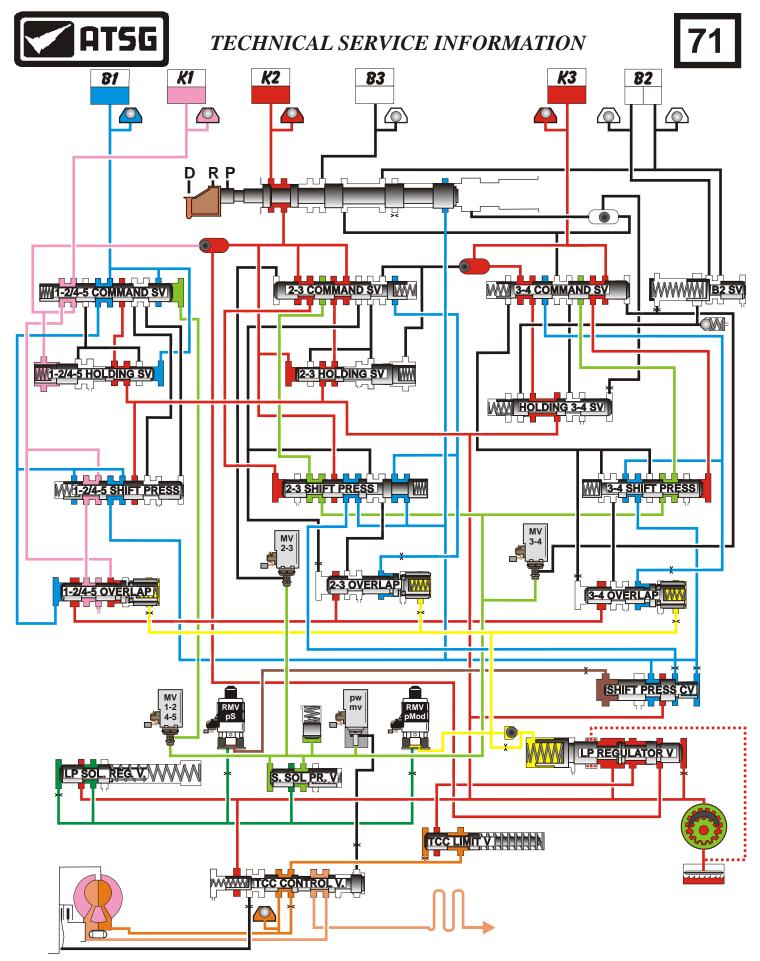
DRIVE THIRD GEAR



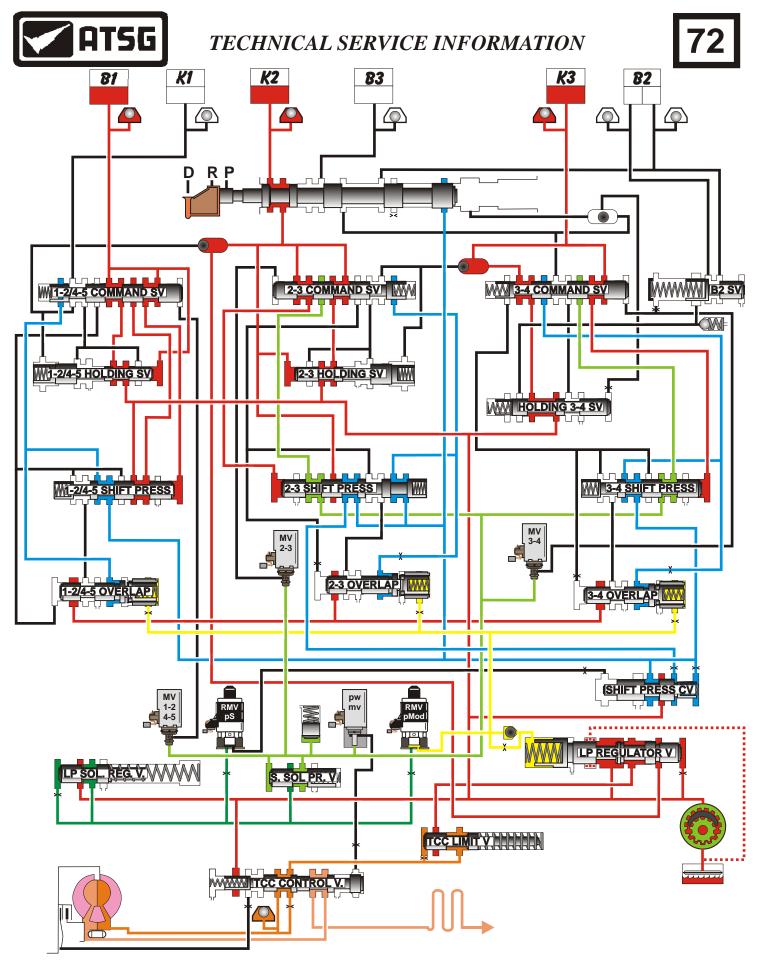
TRANSITION INTO FOURTH GEAR



DRIVE FOURTH GEAR

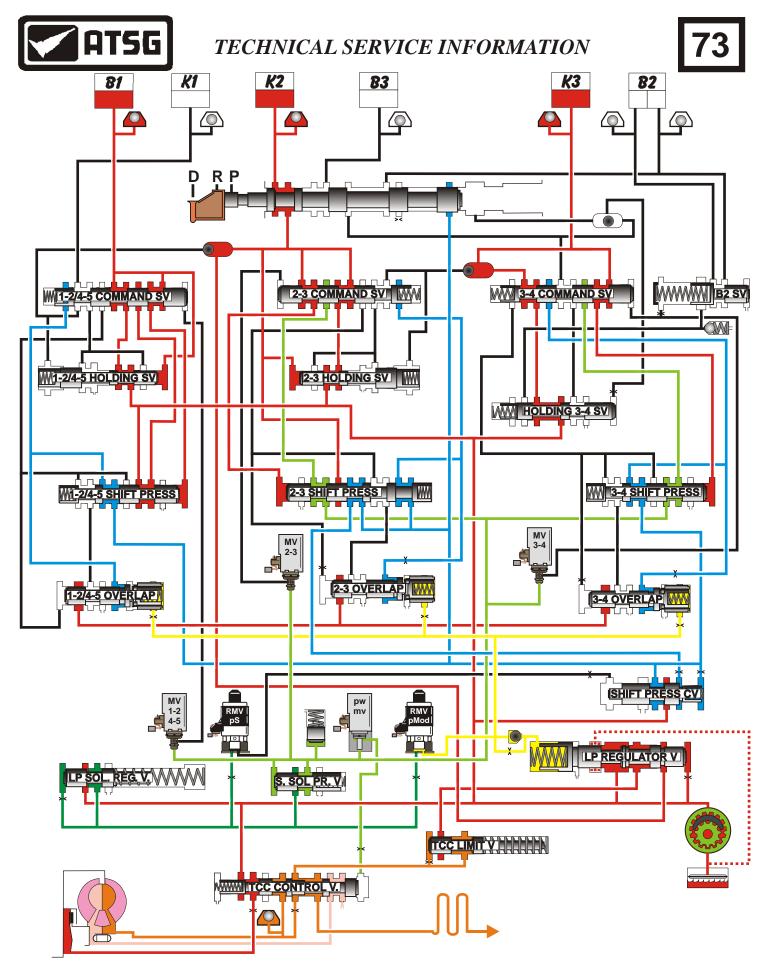


TRANSITION INTO FIFTH GEAR



FIFTH GEAR

Automatic Transmission Service Group



FIFTH GEAR - TCC MODULATION





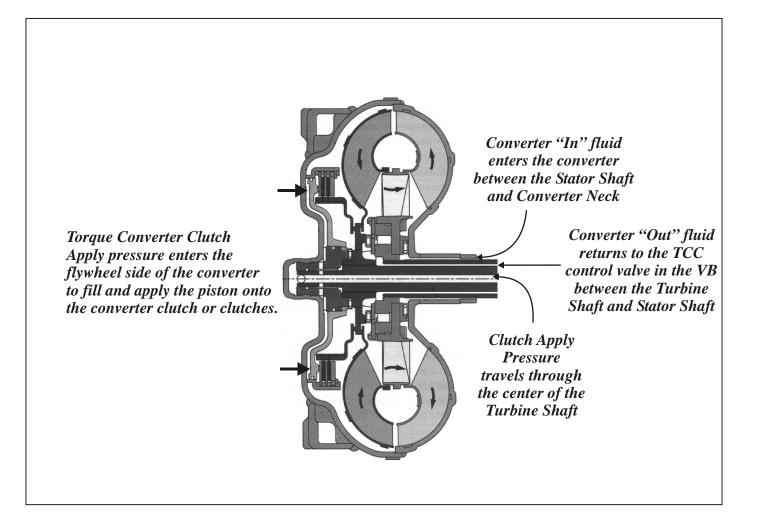
# **DIAGNOSING THE 722.6 TRANSMISSION**

#### THE TORQUE CONVERTER

The Torque Converter is uniquely constructed in that the converter clutch apply circuit is independent to the converter in and out fluid. Additionally, the converter could contain either 1 or 2 friction plates depending on the size of the engine.

The figure below illustrates how the converter clutch apply piston contours to the flywheel side of the torque converter cover. The friction plate/s lug to a hub splined to the turbine shaft while the steel plates lug to the converter cover. When the clutch is commanded on, fluid travels through the center of the turbine shaft and fills the area between the converter cover and piston. The piston applies the friction plate/s to the steel plates locking the turbine shaft to the cover.

As illustrated below, the converter clutch hydraulic circuit is independent from the converter in and out circuits. Converter fill comes into the converter from between the converter neck that drives the pump gears and the stator shaft. The fluid's return path is between the stator shaft and turbine shaft. Hydraulic circuit identification of the case and converter housing can be seen on the following two pages.





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# **Scanner Information**







# **Understanding Mercedes Adaptation Shift Strategy**

#### Getting familiar:

For those who are familiar with Daimler/Chrysler's 41TE and 42LE transmissions know that the controller operating these transmissions adapts each of their shifts utilizing a Clutch Volume Index (CVI) strategy. Chrysler's definition of CVI goes something like this: A Clutch Volume Index or learned clutch volume represents the volume of fluid that is required to stroke a clutch piston to the point where clutch pack clearance is obtained, without stroking the accumulator or picking up any torque load on the clutch. For simplicity sake, it basically indicates the amount of time it takes to make a shift. Chrysler monitors the following shifts to aquire learned clutch fill times: The 1-2, 2-3, 4-3, 4-2, 3-1 and 2-1. By these observances, the controller can tailor solenoid operation adapting for each shift compensating for possible increased clutch clearance. Mercedes adaptation principal operates in a similar manner in that it monitors shift time (the time it takes to change from one gear ratio to another) and lengthens or shortens the shift as needed so as to provide a consistent comfortable shift feel. However, the system Mercedes utilizes is far more sophisticated as compared to Daimler/Chrysler (consistent with Mercedes) as the speed of its communication system is much faster. Mercedes utilizes a CAN BUS system whereby information can travel at a rate of approximately 1 million bites per second.

#### The Communication System:

In the general computer world there are many types of networks. In your office there is a "Local Area Network," or "LAN." The Internet is a very large "WAN" or "Wide Area Network." In the Mercedes they use a "CAN" or "Controller Area Network."

The hardware, or communications link, in these networks are all very different, but the way the actual information is packaged, sent, and received is very similar. Information is assembled into a packet. The electronic address of the unit(s) where the packet is going is added to the front of the packet, and the packet is sent on a common communications link along with packets to and from other units. All of the units (or modules in the case of a CAN) "hear" all of the packets all of the time. They just don't "listen" unless it has their address as the destination.

The actual communications link in a CAN is a single twisted pair. This is two pieces of wire which are twisted together (no electrical contact). The type of wire, type of insulation, and the number of twists per inch are all critical. These factors change electrical characteristics such as EMI/RFI susceptibility and electrical impedance. The signals across a CAN operate at a very high frequency allowing a large amount of information to be transmitted. Twisted pair network busses are normally terminated (either at both ends or at each module) with a specific resistance. Although necessary for other reasons, this terminating resistance may be used to detect and troubleshoot faults on the wire.

#### WELCOME TO MERCEDES ADAPTATION PROGRAM

The following data has been compiled from information provided by Mercedes to be used in supervised training by qualified MB technicians. Procedures and values may change without notice. The information provided here is in conjunction with Mercedes dedicated diagnostic equipment known as the "Star Diagnosis." This is a PC connected to the vehicle through a piece of hardware called the Multiplexer. The Computer runs a program called the DAS (Diagnosis Assistance System) and the WIS (Werkstattinformationssytem / Workstation Information System) which also includes the HHT (Hand Held Scanner) software. Although this information is tailored for Mercedes equipment, Generic Scan Tools such as the Snap-On MT2500 scanner has come forth with their Mercedes Primary Cartridge. This Cartridge will allow the technician to view Adaptation. Therefore, the following pages will prove to be useful preparatory information for the serious transmission diagnostician.





# Driving Style Adaptation:

The Driving Style Adaptation program in the Electronic Transmission Control Module (ETC), lives for the moment meaning that it does not retain any particular driving condition for a later date. The ETC will monitor, adapt and respond in shift feel and timing immediately from the following inputs:

- 1. The vehicles acceleration and deceleration activity.
- 2. The rate of change as well as the position of the throttle pedal.
- 3. Lateral acceleration (The speed in which turns are taken).
- 4. The frequency of gear change

# The Shift Time Adaptation:

Shift Time Adaptation is the time it takes to make a shift from one gear into another. It is defined as the time it takes to disengage one clutch pack while another is being applied (i.e. Shift Overlap). Specific values are needed to make the Shift Time Adaptation and these values are written to memory enabling the ETC to adapt during the following shift occurrences:

1. Accelerating Up-shift adaption: Up-shifts that occur under load

2. Deceleration Up-shifts adaption: Up-shifts that occur under no load

3. Accelerating Down-shifts adaptation: Down-shifts that occur under load

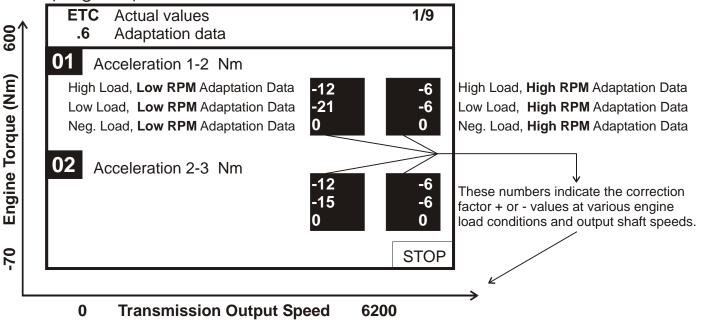
4. Deceleration Down-shifts adaptation: Down-shifts that occur under no load (i.e. coast down shift)

These values are represented in Newton meters (Nm) meaning "Torque." In other words, the strength of the shift. There are no ideal numbers to achieve, however a 0 indicates that a clutch pack does not require adaptation or the clutch pack has not yet adapted. If an adaptation value is at its maximum value, and the shift is unacceptable, repair work may be required. Additional adaptation cannot be achieved when the following values are reached:

#### Maximum values in Nm:

8 and 12 cylinder engines have a + or - 210 Nm6 cylinder engines have a + or - 180 Nm4 cylinder engines have a  $+ \, \text{or} - 150 \, \text{Nm}$ 

Analyzing Adaptation for Shift Time Data as seen on the HHT - Hand Held Scanner







# The Shift Time Adaptation continued:

Viewing the 1-2 up-shift as our example in the HHT Adaptation window, the low numbers indicate that a small amount of adaptation was required to optimize the shift. It is the K1 clutch that is applied on the 1-2 up-shift. Therefore, we can conclude that the clutch clearance for the K1 clutch is within specification tolerances. It also indicates that there are no excessive leaks in the circuit as well.

The following key points must be observed when performing and viewing a re-learn adaptation procedure on a 722.6. It is recommended to have a driving assistant enabling you to be free to concentrate and observe the scanner data.

- 1. The ideal transmission fluid temperature should be 176 to 194°F (80 to 90°C) however 140 to 221°F (60 to 105°C) is acceptable.
- 2. Turn A/C Off and drive the vehicle on a level road with light throttle.
- 3. Do not exceed maximum engine RPM during the shift process, refer to the example charts below.
- 4. Refer to the "Adaptation Torque Requirement" example charts below.
- 5. Let the **engine idle for ten minutes** after the adaptation process or you will lose the new adaptation data.
- 6. To assure effective adaptation, clutch packs must apply and release at least 8 times for M119 and M120 engines and a minimum of 4 times for M104, M111 and OM606 engines.

Adaptation Torqu	Adaptation Torque Requirement chart for Shift Time - M104, M111 and OM606				
Shift	Torque	Torque	Torque	Torque	
Engine	M104.941	M111.973	M111.974	OM606.912	
1-2	14-36 Nm	15-36 Nm	15-28 Nm	14-27 Nm	
2-3	20-59 Nm	20-59 Nm	20-59 Nm	20-55 Nm	
3-4	20-45 Nm	20-45 Nm	20-46 Nm	15-54 Nm	
4-5	0-121 Nm	0-121 Nm	0-82 Nm	0-81 Nm	
Max. Engine Speed	= 2400 RPM	2400 RPM	2400 RPM	1800 RPM	

Adaptat	Adaptation Torque Requirement chart for Shift Time - M119 and M120						
Shift <b>Up-shift</b> Member Very Light Throttle		<b>Downshift</b> Idle Throttle (w/o shifter)	Permissible Engine Torque During the shift process <b>M119 4.2 liter</b>	Permissible Engine Torque During the shift process M119 4.2 liter and M120			
K1	1-2	-	20-40 Nm	20-50 Nm			
K2	2-3	-	20-70 Nm	20-80 Nm			
К3	3-4	-	0-60 Nm	0-140 Nm			
B1	4-5	-	0-110 Nm	0-140 Nm			
B2	-	4 -3	0 to -50 Nm	0 to -50 Nm			
K1	-	5-4	0 to -50 Nm	0 to -50 Nm			
Max. Eng	ine Speed =	1800 RPM					



### Shift Time Adaptation continued:

The shift time is controlled by the TCM through a combination of "Fill Pressure" and "Fill Time" strategy. This type of strategy allows the controller to manage the "Shift Time" by determining the amount of pressure needed to engage the clutch as well as the time needed to fill the drum behind the piston to apply the clutch pack. In other words, the Shift Time reports to the TCM how hard or soft (how short or long) the shift was. The TCM then adjusts the shift feel by controlling how much pressure is used to apply the clutch as well as controlling the flow rate to that particular clutch drum.

# Fill Pressure Adaptation:

Fill pressure adaptation is the ability of the ETC module to modify the pressure used to engage the clutch pack. The value of this pressure determines how firm the shift will be. If too much pressure is used the shift will be hard. Likewise, if too little is used the transmission may slip. Fill pressure adaptation values are written to memory and the ETC module can make adjustments that affect shift quality. The following is an HHT screen reporting Fill Pressure Adaptation data.

Analyzing Adaptation for Fill Pressure Data as seen on the HHT

	<ul><li><b>TC</b> Actual values</li><li><b>6</b> Adaptation data</li></ul>
17	Fill pressure 1-2
	-400 mbar MAX 1600
18	Fill pressure 2-3
	-100 mbar
19	Fill time K1 in 2nd gr.
	0 Cycle
20	Fill time K2
	0 Cycle
21	Fill time K3
	0 Cycle

MT2500 Scanner display and booklet information:

Fill pressure for specific up-shifts. This group includes the following parameters:

FILL PRESSURE 1-2(mbar)_XXXX	(range: 0 to 1600 mbar)
FILL PRESSURE 2-3(mbar) _XXX	(range: 0 to 800 mbar)

The ETC calculates these adaptive values based on the current draw from the solenoid shift valve. These values compensate for tolerances in the solenoid valve, the modulated shift pressure valve, and for the tension on the return spring for the respective shift member. Higher values indicate that the ETC is increasing fill pressure to create a harder shift. Lower values indicate that the ETC is decreasing fill pressure to create a softer shift. A value of 0 mbar means that either the ETC has not stored an adaptive value, or that the shift member does not require correction. A value at the parameters upper limit, along with poor shift quality, indicates the need for repair.





# Fill Time Adaptation:

Fill Time Adaptation is the ability of the ETC module to modify the time it takes to fill the clutch pack. Fill time is the time it takes to fill the clutch drum behind the apply piston taking all the clearance up but not applying the clutch pack. This adaptation compensates for the condition of the clutches and steel plates and the clearance between them. The certain values (i.e. previous shift condition, etc..) needed to make these adapts are written to memory.

Analyzing Adaptation for Fill Time Data as seen on the HHT

ET .6	<ul><li>C Actual values</li><li>Adaptation data</li></ul>		9/9
22	Fill time B1	0 Cycle	
23 24	Fill time B2 Fill time K1	0 Cycle	MAX 15
		0 Cycle	

MT2500 Scanner display and booklet information:

Fill time for specific clutch and brake pack shift members. This group includes the following parameters:

FILL TIME K1 IN 2ND GEAR CY	CLE_XX	(range: 0 to 15 cycles)
FILL TIME K1 IN 4TH GEAR CYC	CLE_XX	
FILL TIME K2 CYCLE_XX	FILL TIME K	3 CYCLE_XX
FILL TIME B1 CYCLE_XX	FILL TIME B	2 CYCLE_XX

These data parameters display adaptations to the length of time it takes to fill the clutch (K) and brake (B) shift members with ATF to remove the clearances just before application. These adaptations compensate for the condition of the clutches, the number of steel plates, and the clearance between the steel plates.

The ETC sends an amplitude-modulated current to the fill solenoids. The greater the signal amplitude, or difference between the crests and troughs of the signal, the greater the pressure. The ETC can only change signal amplitude once per 20 milliseconds (ms). This prevents overcorrection. Each cycle displayed by these data parameters equals one 20-ms period. If the Scanner reports a fill time adaptation of 3 cycles, this means that it took three periods of 20-ms each (60 ms) to alter pressure enough to accomplish the correct application of the shift member.

The maximum fill correction time is 15 cycles, or 300 ms. A value of 0 cycles indicates no fill correction was needed.





# **Diagnostic Trouble Codes**

	DTC's		LIMP	AUTO	KEY
DTC	DTC DTC INT OBD	DESCRIPTION		RESET	
2	98 P0753	1-2/4-5 SHIFT SOLENOID	Х		
3	99 P0758	2-3 SHIFT SOLENOID	Х		
4	100 P0763	3-4 SHIFT SOLENOID	Х		
5	101 P0743	PWM LOCK-UP SOLENOID	Х		
6	102 P0748	MODULATING PRESSURE REGULATING SOLENOID	X		
7	103 P0748	SHIFT PRESSURE REGULATING SOLENOID	X		
8	104	R/P LOCKOUT SOLENOID			Х
9	105	STARTER LOCKOUT RELAY MODULE			Х
10	106 P0702	SOLENOID VOLTAGE SUPPLY OUT OF RANGE	Х		
11	107 P0715	RPM SENSOR VOLTAGE SUPPLY OUT OF RANGE	X		
12	108 P0715	RPM SENSOR n2	X		
13	109 P0715	RPM SENSOR n3	X		
14	110 P0715	RPM SENSOR 2 TO 3 COMPARISON IMPLAUSIBLE	_	-	_
15	111 P0700	EXCESSIVE RPM SENSOR 2 OR 3	_	_	_
17	113 P0705	TRRS CODING INVALID	_	_	_
18	114 P0705	TRRS IMPLAUSIBLE	_	—	_
18	114	SELECTOR LEVER POSITION IMPLAUSIBLE	Х	Х	
19	115	ATF TEMPERATURE SENSOR	С		
20	116	STARTER INTERLOCK CONTACT/ATF FAULTY	E		
21	117	TCM VOLTAGE OUT OF RANGE - CIRCUIT B7	X	Х	
22	118 P0720	CAN: WHEEL SPEED SENSOR, RIGHT REAR, FAULT	X,A,C	X	
23	119 P0720	CAN: WHEEL SPEED SENSOR, LEFT REAR, FAULT	X,A,C		
24	120	CAN: RF WH SPD SEN FAULT or Pedal Value Implausible		X X	
25	121	CAN: LF WH SPD SEN FAULT or Eng RPM Implausible		Х	
26	122	CAN: ACC. PEDAL POSITION or Eng Torque Implausible	В	Х	
27	123	ADJ. ENG. or STATIC ENG. TORQUE IMPLAUSIBLE	_	—	_
28	124	CAN: ENGINE RPM IMPLAUSIBLE	B or D	Х	
29	125	CAN: ENGINE TORQUE, RIGHT, IMPLAUSIBLE	B or D	Х	
30	126	CAN: ADJ ALTITUDE IMPL. or Tract.Cont. Comm. Error	В	Х	
31	127	ENG. MNGT. TORQUE IMPLAUSIBLE or Comm. Error	-	-	_
32	128	CAN: ENGINE TORQUE MANAGEMENT IMPLAUSIBLE	B or D	Х	
33	129	CAN: THROTTLE VALVE ACTUATOR IMPLAUSIBLE	_	-	—
34	130 P0720	CAN: TRRS MOD (N15/5) IMPL. or ENG. MNGT. FAULT	_	—	_
35	131	CAN: ME 1.0, LEFT, INFORMATION DISTORTED	B or D	Х	
36	132	CAN: ME 1.0, RIGHT, INFORMATION DISTORTED	В	Х	
36	132	ENGINE COOLANT TEMPERATURE IMPLAUSIBLE	В	Х	
37	133	CAN: INFORMATION TOTALLY DISTORTED	X,B	Х	
38	134 P0720	CAN: ESP INFORMATION DISTORTED or TRAC. CNTL.	X,B	Х	
39	135	CAN: ME 1.O, RIGHT, INFORMATION DISTORTED	B or D	Х	
40	136	CAN: INSTRUMENT CLUSTER COMM. ERROR	_	_	_
41	137 P0700	TRANSFER VASE CNTRL. MODULE COMM. FAULT	_	—	_
49	145 P0700	EXCESSIVE ENGINE RPM	—	—	_
50	146 P0700	EXCESSIVE RPM SENSOR 3	_	—	_
51	147 P0700	ENGAGED GEAR IMPLAUSIBLE (TRANS SLIPPING)			Х
52	148 P0700	COMMAND VALVE STUCK IN PRESSURE POSITION OR TCC STUCK ON	Х		Х



	DTC's					
DTC	DTC DTC INT OBD	DESCRIPTION	LIMP MODE	AUTO RESET	KEY RESEI	
53	149 P0740	TORQUE CONVERTER LOCK-UP CLUTCH SLIPPING	NO LOCK-UP			
54	150	CONFIRMATION OF TRANSMISSION OVERLOAD	boon or			
		PROTECTION NOT RECEIVED				
55	151 P0730	GEAR RECOGNITION REPEATEDLY NEGATIVE	Х			
56	152 P0702	ETC CONTROL MODULE (EEPROM: INCORRECT CODING	Х			
57	153 P0702	ETC CONTROL MODULE (CLOCK)		_		
58	154 P0702	ETC CONTROL MODULE (INTERNAL TEST WATCHDOG)	X			
59	155 P0702	ETC CONTROL MODULE (EXTERNAL TEST WATCHDOG)	X			
50	156 P0702	ETC CONTROL MODULE (INTERNAL FUNCTION WATCHDOG)	F			
<u>61</u>	157 P0702	ETC CONTROL MODULE (EXTERNAL FUNCTION WATCHDOG)	F			
62	158 P0702	ETC CONTROL MODULE (RAM)	X			
<u>63</u>	159 P0702	ETC CONTROL MODULE (ROM)	X			
<u>64</u> 65	160 P0702 161 P0702	ETC CONTROL MODULE (EEPROM: CRITICAL FUNCTIONS) ETC CONTROL MODULE (EEPROM: NONCRITICAL FUNCTIONS)	X B			
<u> </u>	101 10702	ETC CONTROL MODULE (EEI ROM, NONCRITICAL FUNCTIONS)	D			
		After moving shift lever to Park, cycle ignition key Off, wait engine, engaged gear will be 2nd and reverse only. To restor ( <i>if error is nonexistent</i> ): clear malfunction memory, cycle i restart engine.	e transmi	ssion fun	ction	
AU	J <b>TO RESET</b>	$(\mathbf{X})$ = Error reaction eliminated after fault condition ends.				
KI	EY RESET (2	<b>X</b> ) = Error reaction eliminated by cycling ignition key OFF/ON.				
<b>A</b> =	-	only when faults 22 and 23 occur simultaneously. With implausib ts to preprogrammed fixed substitution value, $(L/RR, R/RR = 250)$	0	input, co	ntrol	
<b>B</b> =	= With implat	usible signal input, control module defaults to preprogrammed fixe	d substit	ution valu	ıe.	
<b>C</b> :		usible signal input, control module defaults to variable substitution sensor input).	value (w	vith loss c	of one	
<b>D</b> = With implausible signal input, control module defaults to variable substitution value from other half of engine control.						
$\mathbf{E} = \text{Delayed starting.}$						
F -	= Error induce	es control module to reinitialize from beginning (reset)				
	$\mathbf{F}$ = Error induces control module to reinitialize from beginning (reset).					



|--|

DIAGNOSTIC TROUBLE CODE	DESCRIPTION	
P0100	MAF CIRCUIT FAULT	
P0105	MAP CIRCUIT FAULT	
P0110	IAT CIRCUIT FAULT	
P0115	ECT CIRCUIT FAULT	
P0120	THROTTLE POSITION CIRCUIT FAULT	
P0500	VSS SENSOR FAULT	
P0560	SYSTEM VOLTAGE MALFUNCTION	
P0700	TRANSMISSION CONTROL SYSTEM MALFUNCTION	
P0702	TRANSMISSION CONTROL SYSTEM ELECTRICAL MALFUNCTION	
P0715	TURBINE SPEED SENSOR CIRCUIT FAULT	
P0720	OUTPUT SPEED SENSOR CIRCUIT FAULT	
P0730	INCORRECT GEAR RATIO	
P0740	TORQUE CONVERTER CLUTCH MALFUNCTION	
P0743	TORQUE CONVERTER CLUTCH ELECTRICAL CIRCUIT FAULT	
P0748	MODULATION/SHIFT PRESSURE REGULATING SOLENOID CIRCUIT FAULT	
P0753	1-2/4-5 SHIFT SOLENOID ELECTRICAL CIRCUIT FAULT	
P0758	2-3 SHIFT SOLENOID ELECTRICAL CIRCUIT FAULT	
P0763	3-4 SHIFT SOLENOID ELECTRICAL CIRCUIT FAULT	
P1584	STOP LAMP SWITCH FAULT	
P1747	CAN SIGNAL FROM ETC FAILURE	

#### DIAGNOSTIC LINK CONNECTOR (DLC) INFORMATION

There can be 4 different diagnostic connector styles depending on year of production, car model, if the vehicle is equipped with California emissions or if the vehicle is OBD-II compliant.

- **DLC #1 -** This DLC is located in the engine compartment and is a 16 pin diagnostic connector which is used with a "Code Reader" and will produce 2 digit codes.
- **DLC #2** This DLC is located in the same location as DLC #1 and is very similar in appearance. This DLC has an L.E.D. Lamp with a push button to retrieve 2 digit codes. This style connector is typically used with California emissions.
- **DLC #3 -** This DLC is also located in the engine compartment and is a round 38 terminal connector that requires a diagnostic code reader to retrieve 2 digit codes.
- **DLC #4 -** This DLC is the 16 terminal OBD-II connector located under the driver side dash. This will require a scan tool in order to retrieve the typical OBD-II 5 digit codes.





# **Electrical** Information

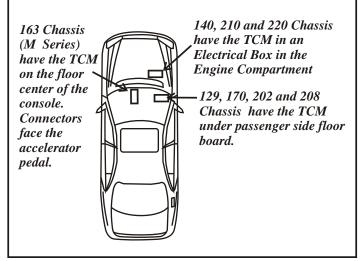


Figure 89



Figure 90

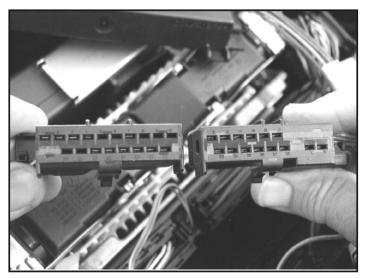


Figure 91

Electrical checks related to the 722.6 transmission can be easily conducted as the TCM is located in one of three accessible areas as shown in Figure 89. The TCM is small in size when compared to the other computers on board the vehicle. It measures approximately 5 1/4" x 4 1/4" x 3/4" (See Figure 90). There are two connectors which plug into the TCM. The face of each of the connectors have embossed in them terminal numbers for circuit identification as shown in Figure 91. At the "neck" of each of the two connectors is a wire tie that can be removed to gain access to the wires coming in from behind the connector (See Figure 92). Once the wire tie is removed the outer protective covering can slide off of the connector as shown in Figure 93. Once the sleeve is removed, numbers are also embossed into the side of the connector for easy circuit ID (See Figure 94).

With the protective sleeve removed, the wires, the wire terminal ends as well as the integrity of the connector can all be easily inspected. Various electrical checks can also be performed. The connector could be plugged back into the TCM with the sleeve removed allowing the technician to back probe specific circuits for testing. The Hall Effect Sensors, the Transmission Fluid Temperature Sensor, the Transmission Range Recognition Switch, the Shift Solenoids and Pressure Control Solenoids could all be monitored without difficulty.

With the connector unplugged, resistance checks can be performed on many of the transmissions internal

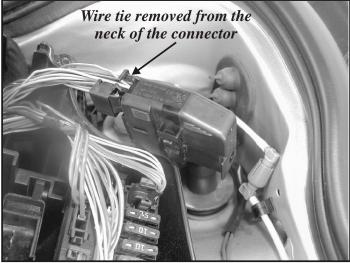


Figure 92





electrical components. If a specific wire needs to be inspected, continuity checks could also be performed from the TCM connectors to the main harness connector which plugs into the transmission (See Figure 95).

Use Figure 96 for TCM terminal identification and Figure 97 for the transmission harness terminal identification. Figure 98 provides resistance data check chart as well as some TCM update and part number information.

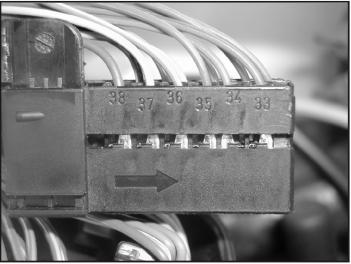


Figure 94

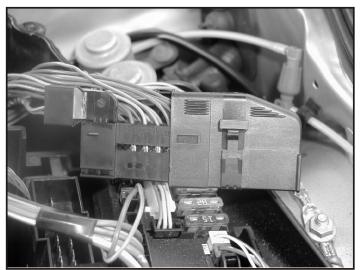


Figure 93



Figure 95





163 Chassis (M Series) have the TCM on the floor center of the console	140, 210 and 220 Chassis have the TCM in an Electrical Box in Engine Compartment 129, 170, 202 and 208 Chassis have the TCM under passenger side floor board 1 10 12 17 1 10 12 17		
TCM TERMINAL #	FUNCTION		
	DIAGNOSTIC OUTPUT		
2	KICKDOWN SWITCH		
	R/P LOCK SOLENOID		
	NOT USED		
7	PASSENGER FUSE & RELAY MODULE BOX		
	NOT USED		
	STOP LAMP INPUT		
	NOT USED		
	RPM SENSOR VOLTAGE SUPPLY		
	1-2/4-5 SHIFT SOLENOID		
	3-4 SHIFT SOLENOID		
	2-3 SHIFT SOLENOID		
	PWM LOCK-UP SOLENOID		
	NOT USED		
26	26 TRANSMISSION RANGE RECOGNITION SWITCH		
	TRANSMISSION RANGE RECOGNITION SWITCH		
28	TRANSMISSION RANGE RECOGNITION SWITCH		
	TRANSMISSION CONTROL MODULE VOLTAGE SUPPLY		
	TRANSMISSION CONTROL MODULE GROUND		
	RPM SENSOR n2 & n3 GROUND and ATF GROUND		
	ATF TEMPERATURE SENSOR		
	RPM SENSOR n3 SIGNAL		
	MODULATOR PRESSURE REGULATING SOLENOID		
	SHIFT PRESSURE REGULATING SOLENOID		
	SOLENOID VOLTAGE SUPPLY		
	CAN DATA LINE LOW (-)		
	CAN DATA LINE HIGH (+)		



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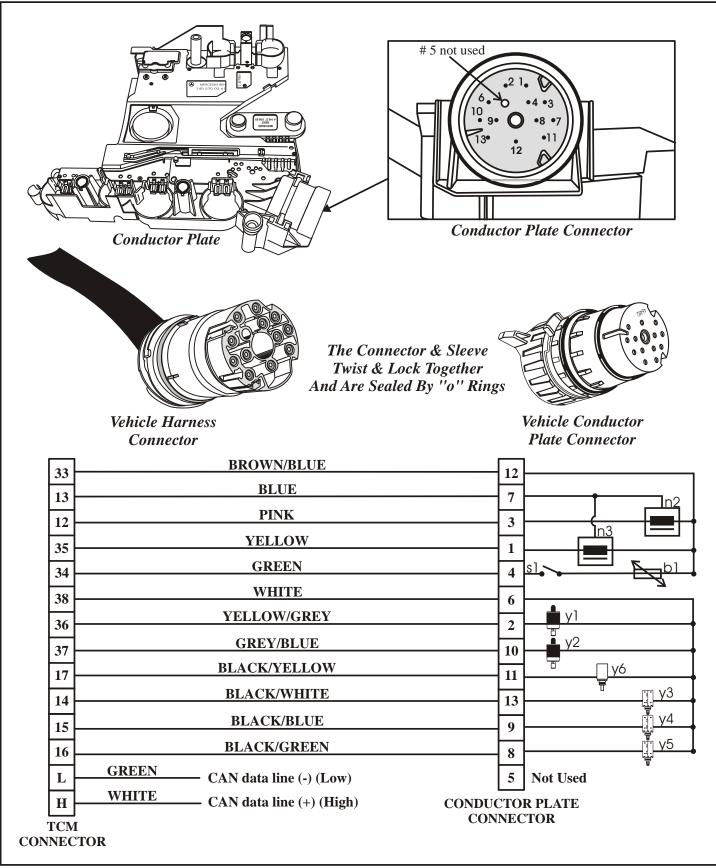
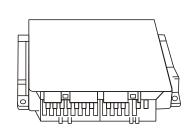


Figure 97 *Automatic Transmission Service Group* 





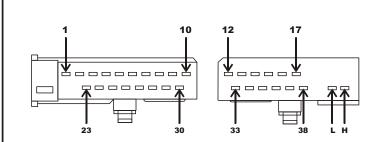


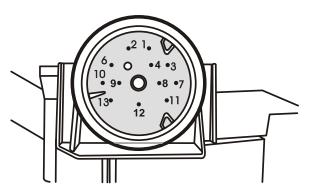
Models 129, 140, 170, 202, 208 and 210 have had updated Electronic Transmission Control Modules in order to desensitize setting of codes 053, 134, 146 and 149. These updated modules also improve 1-2 full throttle shifts and 3-2 downshifts. The part numbers for these modules are as follows:

M119/120 engines - 026 545 72 32M113 engine- 026 545 73 32M112 engine- 026 545 84 32M111 engine- 026 545 82 32M104 engine- 026 545 85 32

For the 220 Models, the updated module part number is: 022 545 51 32. Only early vehicles did not receive this module from the factory.

These part numbers do not apply to triptronic shifted vehicles or AMG vehicles.





TCM TO CONDUCTOR PLATE TERMINAL CHART						
TCMCONDUCTOR PLATETERMINAL #TERMINAL #		COMPONENT	COMPONENT VALUE			
33	12	SENSOR GROUND	.01 VOLTS OR LESS			
13	7	RPM SENSOR VOLTAGE SUPPLY	4-8 VOLTS			
12	3	RPM SENSOR n2 SIGNAL	VOLTAGE PULSE			
35	1	RPM SENSOR n3 SIGNAL	VOLTAGE PULSE			
34	4	ATF TEMP SENSOR/STARTER LOCK-OUT	N/A			
38	6	SOLENOID VOLTAGE SUPPLY	SYSTEM VOLTAGE			
36	2	MODULATED PRESSURE REGULATOR SOLENOID	5.5 OHMS			
37	10	SHIFT PRESSURE REGULATOR SOLENOID	5.5 OHMS			
17	11	PWM CONVERTER CLUTCH SOLENOID	2.7 OHMS			
14	13	1-2/4-5 SHIFT SOLENOID	4.5 OHMS			
15	9	3-4 SHIFT SOLENOID	4.5 OHMS			
16	8	2-3 SHIFT SOLENOID	4.5 OHMS			
	5	NOT USED				





# Electrical Information

# TRRS

The center gear shift mechanism as seen in Figure 99 conatins an electrical Transmission Range Recognition Switch (TRRS) and the Park/Lock Solenoid. The TRRS informs the TCM of both the gear shift selection as well as the Winter or Standard Mode selection.

With the TRRS being an integral part of the gear shift mechanism which is located on the floor center console, rain water from an open sun roof, a coffee or soda spill is all it takes to damage this switch. As you can see in Figure 100, with the face plate removed, the TRRS circuit board can be easily seen. This explains why it is so easily damaged. This circuit board has attached to it wires (See Figure 101) which run to a connector in the rear of the assembly (See Figure 102).

When this switch is damaged, it may cause delayed engagements or no up shifts. Sometimes it will not allow the Park/Lock solenoid to release. If you encounter a shifter that will not move out of Park, there is an access window below the Gear Select Indicator Panel which will allow you to release the lever using the eraser end of a pencil (See Figure 103). Figure 104 shows the pencil before the release and Figure 105 shows the pencil pushed down and the gear shifter released. Figures 106 and 107 provide additional information as well as an explanation of each gear range with shifters that do not use the "Slap Stick" option as shown in Figure 99.

The Manual Shift version shown in Figures 106 and 107 has its own unique problem. If you notice, when the shifter lever is pulled down into the first Drive position below Neutral, the Driver has the option to push the lever sideways. To the right would allow a shift sequence up to 5th gear while pushed to the left side would prohibit 5th gear. There have been numerous reports of vehicle owners complaining of an intermittent loss of 5th gear by not realizing that the shifter lever was inadvertently knocked over while driving.

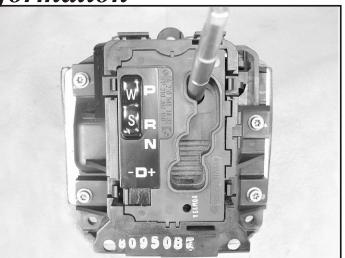


Figure 99

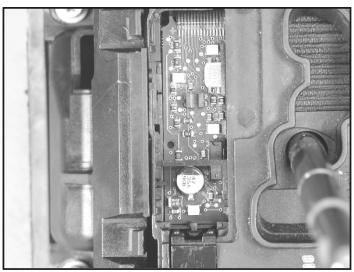


Figure 100

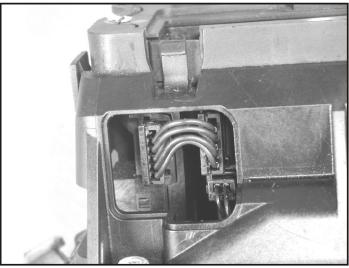
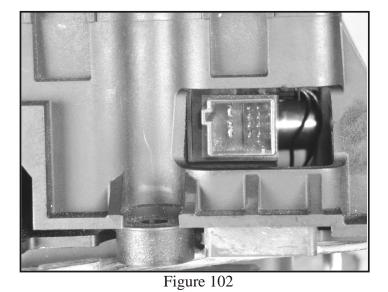


Figure 101







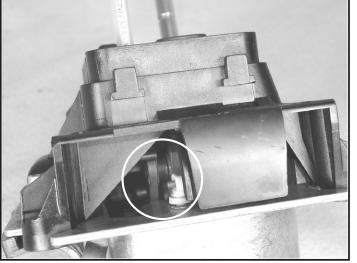


Figure 104

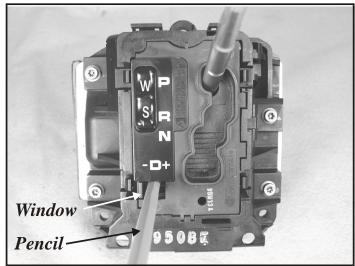


Figure 103

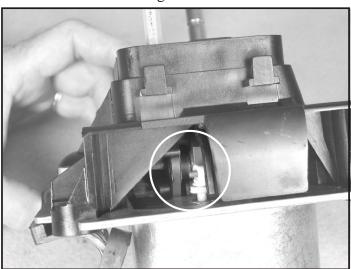


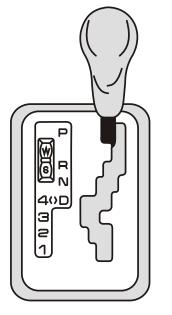
Figure 105



# Shift Quadrant

- **P** = Park Pawl Engaged and Engine Start Position
- **R** = Reverse
- **N** = Neutral...No Power Flow and Engine Start Position
- **D** = Automatic Shift 1st thru 5th gear.
- **4** = Automatic Shift 1st thru 4th gear. 5th gear is locked out.
- **3** = Automatic Shift 1st thru 3th gear. 4th and 5th gears are locked out.
- **2** = Automatic Shift 1st thru 2th gear. 3rd, 4th and 5th gears are locked out.
- 1 = Low Gear Driving Only

# E/S MODE SELECTOR SWITCH OPERATION:



- "S" = This is a Standard driving program with initial take-off in 1st gear.
- "W" = This is a Winter driving program with initial take-off in 2nd gear with the 4<>D position selected. In *Winter Mode* with the reverse position selected, a -1.93:1 gear ratio is available.
  - In *Standard Mode* with the reverse position selected, a -3.16:1 gear ratio is available.

This is to afford the driver a better chance of removing the vehicle from a stuck condition.

### **VEHICLE TOWING:**

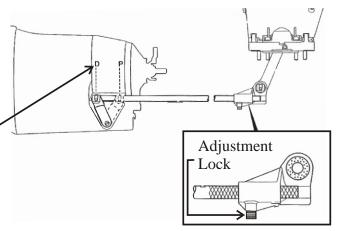
If the vehicle must be flat towed, it should be done with only the "N" position selected for a maximum towing range of 32 miles (50 km) at a maximum speed of 32 mph (50 km/h).

### **LIMPMODE FUNCTION:**

Certain malfunctions will cause the transmission to enter limp mode at which time a diagnostic trouble code will be stored. Should an electrical fault occur, the last selected gear will be the gear the transmission remains in until the vehicle is stopped, the engine is turned off, 10 seconds have passed and the engine is restarted. At this time 2nd gear will be hydraulically available. Should a mechanical/hydraulic fault occur, 3rd gear only will be available. In all situations reverse is also available.

Limp mode remains active until the malfunction is eliminated, or in some cases the key is cycled. In some cases limp mode is canceled because the fault is no longer present.

To adust: With engine OFF, place the selector lever in the Drive Position. Using a #10 Torx, loosen the adjustment lock. Move the Shift Selector Lever all the way forward to the Drive position. Lock the adjustment to 12 Nm/8.8 ft. lbs.





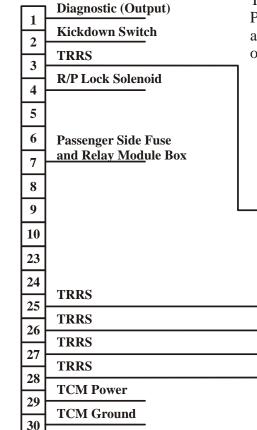


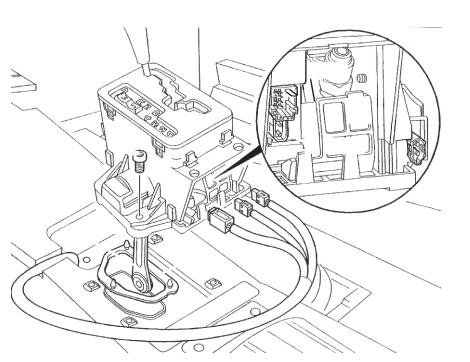
The TRRS is a commonly failed device that produces complaints such as delayed engagements or no up-shifts. The no up-shift complaint is usually accompanied with the TRRS switch manual low indicator light stuck on regardless of the selector lever position. Below is a wiring diagram which could be used to assist in diagnosing the TRRS. However should the switch need to be replaced, the entire shifting assembly needs to be replaced. The assembly illustrated to the right is an early typical design. There is also a shift gate design of P, R, N and -D+ positions allowing slap stick up shift and down shift control. The TRRS plugs in from the front on this design rather than

from the rear as seen to the right.

#### TCM

#### Connector





**NOTE:** The TRRS is so sensitive that it damages if the sun roof is left open and it rains...the same occurs with beverage spillage.

The shift/lock mechanism at times malfunctions locking the shifter in the Park position. There is an access window through the top of the shifter assembly that will allow you to gain access to a release lever with the use of a pencil or small pocket screwdriver (Figures 103-105).

	Hexadecimal Chart					
2	Shifter Position	Approximate Voltage at the TCM Connector Pin No.				
1 Power In		25	26	27	28	
3	Р	10	10	10	0	
	R	0	10	10	10	
7 Ground	Ν	10	0	10	10	
6 4	D	0	0	10	0	
	4	0	0	0	10	
5	3	0	10	0	0	
9	2	10	0	0	0	
	]	10	10	0	10	
TRRS ConnectorMeasured with the TCM connector unplugged and the ignition in the "ON" position.						

Hovadooimal Chart

Figure 107 Automatic Transmission Service Group

