1st Printing
March, 2006

INTRODUCTION
THM 4T65-E
UPDATE HANDBOOK

Since the introduction of the THM 4T65-E transmission in model year 1997, there have been many major engineering design changes to improve durability and reliability. These changes have affected many of the parts used in the THM 4T65-E. This "Update Handbook" will cover preliminary information and will also explain each change, the parts affected by the change, and any parts interchangeability concerns created by the change. This manual is a companion manual to the 4T65-E Blue assembly and disassembly manual and is most helpful during a rebuild.

WAYNE COLONNA
PRESIDENT

DALE ENGLAND
FIELD SERVICE CONSULTANT

PETER LUBAN
TECHNICAL CONSULTANT

JON GLATSTEIN
TECHNICAL CONSULTANT

JERRY GOTT
TECHNICAL CONSULTANT

GERALD CAMPBELL
TECHNICAL CONSULTANT

JIM DIAL
TECHNICAL CONSULTANT

ED KRUSE
TECHNICAL CONSULTANT

GREGORY LIPNICK
TECHNICAL CONSULTANT

DAVID CHALKER
TECHNICAL CONSULTANT

ROLAND ALVAREZ
TECHNICAL CONSULTANT

MIKE SOUZA
TECHNICAL CONSULTANT

AUTOMATIC TRANSMISSION SERVICE GROUP
9200 S. DADELAND BLVD. SUITE 720
MIAMI, FLORIDA 33156
(305) 670-4161

THM 4T65-E
UPDATE HANDBOOK

INDEX

AUTOMATIC TRANSMISSION SERVICE GROUP
9200 S. DADELAND BLVD. SUITE 720
MIAMI, FLORIDA 33156
(305) 670-4161

GENERAL DESCRIPTION

The 4T65-E is a fully automatic, four speed, front wheel drive, electronically controlled transaxle. It consists primarily of a four element torque converter, two planetary gear sets, a hydraulic pressurization and control system, bands, friction and mechanical clutches, and a final drive planetary gear set with a differential.

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

The two planetary gear sets provide the 4 forward gear ratios and reverse. Changing of the gear ratios is fully automatic and is accomplished through the use of a Powertrain Control Module (PCM), or TCM in Volvo units. The PCM/TCM receives and monitors various electronic sensor inputs and uses this information to shift the transaxle at the optimum time.

The PCM/TCM commands shift solenoids, within the transaxle, On and Off to control shift timing. The PCM/TCM also controls the apply and release of the torque converter clutch, which allows the engine to deliver the maximum fuel efficiency, without sacrificing vehicle performance.

The hydraulic system primarily consists of a vane type pump, control valve body and channel plate. The oil pump maintains the working pressures needed to stroke the servos and clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transaxle.

The friction components used in this transaxle consist of 5 multiple disc clutches and 2 bands. The multiple disc clutches and bands combine with three mechanical freewheel components, 2 sprags or pawl clutches, and a roller clutch, to deliver five different gear ratios through the planetary gear sets. The gear sets then transfer torque through the final drive differential and out to the drive axles.

PLANETARY GEARSET DESCRIPTION

FIRST GEAR (REDUCTION)

The input sun gear is driven counter-clockwise as viewed in Figure 1, by the input clutch and input sprag, while the reaction sun gear drum is held by the 1-2 roller clutch. This results in a reduction of approximately 2.92:1.

SECOND GEAR (REDUCTION)

The input carrier is driven counter-clockwise as viewed in Figure 1, by the second clutch and the reverse reaction drum, while the reaction sun gear drum is held by the 1-2 roller clutch. This results in a reduction of approximately 1.57:1.

THIRD GEAR (DIRECT)

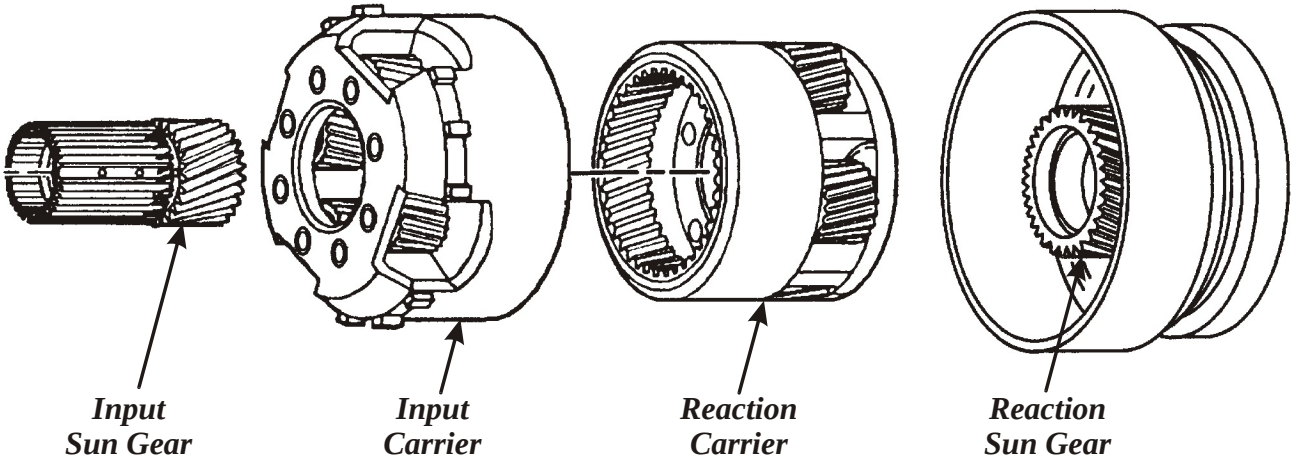
The input carrier is driven counter-clockwise as viewed in Figure 1, by the second clutch and the reverse reaction drum, while the third sprag prevents the input sun gear from turning faster than turbine speed. With these two members of the planetary gearset rotating in the same direction and at the same speed, the result is direct drive which is approximately 1.00:1. In this mode of operation the planetaary pinions do not rotate on their pins, but act as wedges to drive the entire gearset as one rotating part.

FOURTH GEAR (OVERDRIVE)

The input carrier is driven counter-clockwise as viewed in Figure 1, by the second clutch and the reverse reaction drum, while the input sun gear is held stationary by the fourth clutch and shaft. The input planetary pinions "walk" around the stationary input sun gear, driving the reaction carrier faster than the input carrier. This results in an overdrive ratio of approximately 0.71:1.

REVERSE GEAR (REVERSAL)

The input carrier is held stationary by the reverse band and reverse reaction drum, while the input sun gear is driven counter-clockwise as viewed in Figure 1. This causes the planetary pinions to act as idler gears thus driving the reaction carrier in the opposite direction. This results in a reverse ratio of approximately 2.38:1.



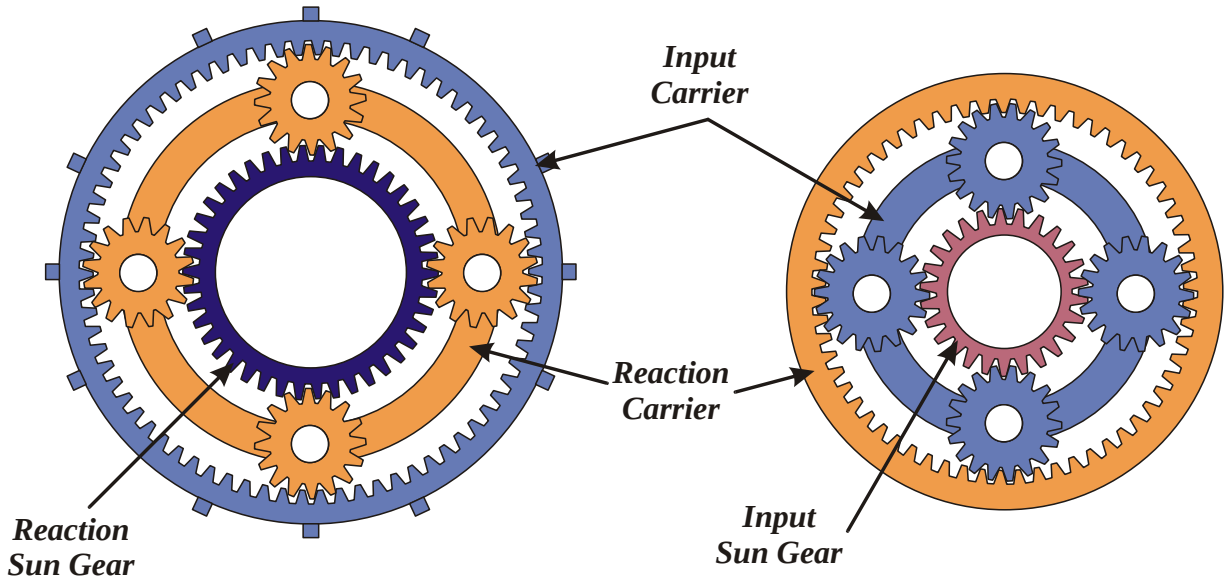
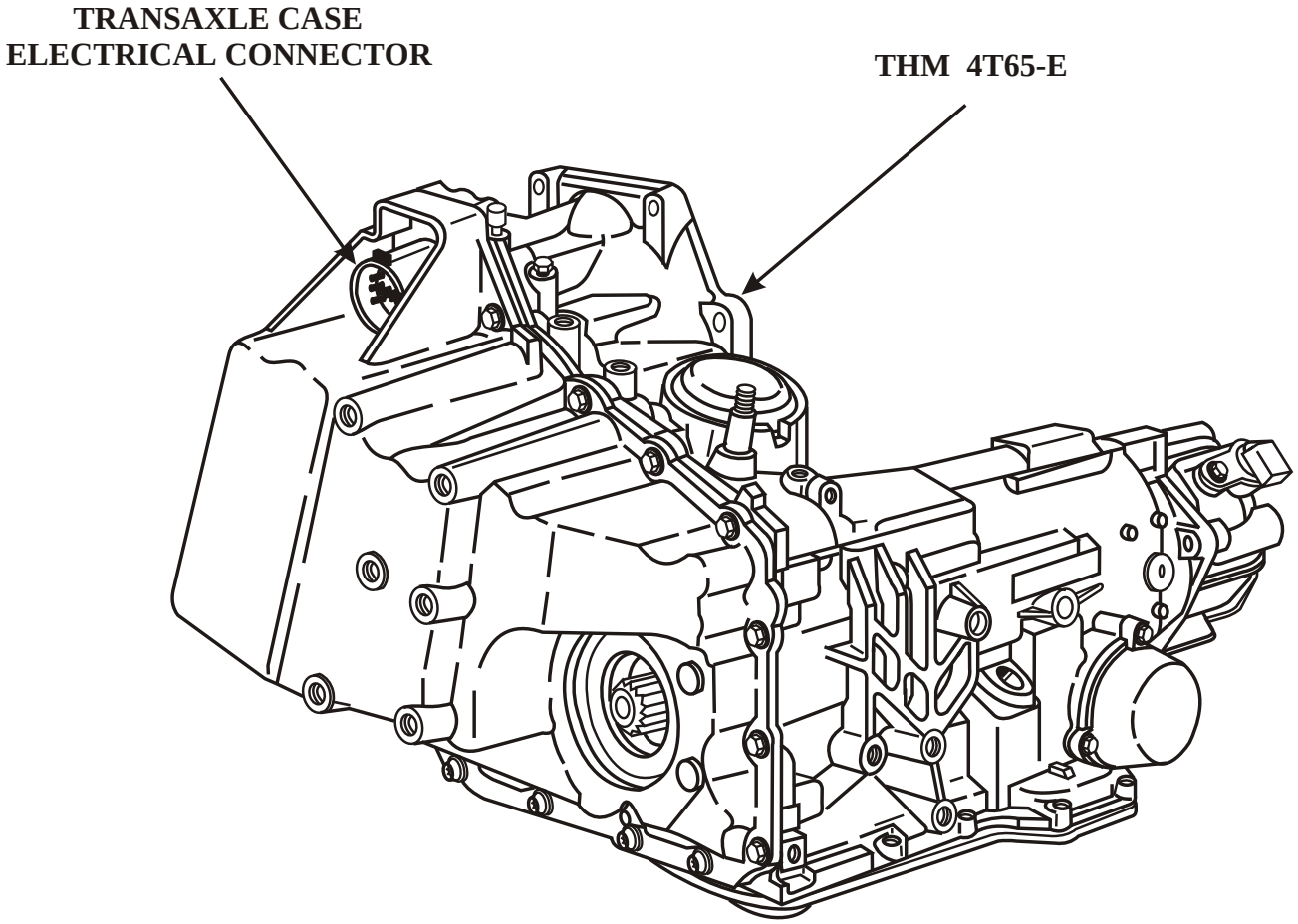


Figure 1

THM 4T65-E
PRELIMINARY INFORMATION

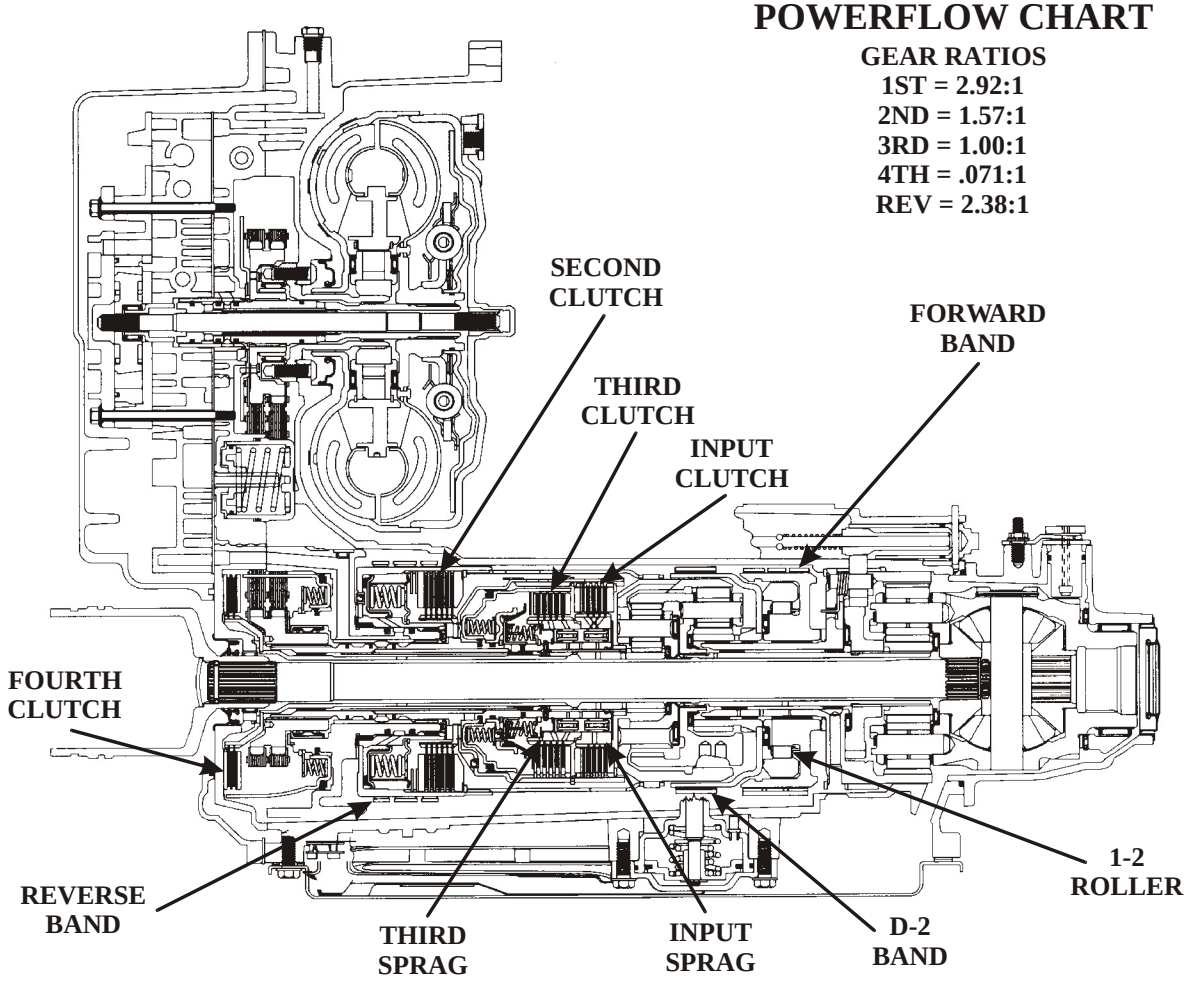


FIRST FOUND IN THE FOLLOWING 1997 MODELS;

Buick Park Avenue (C-Body), 3.8L and 3.8L Supercharged
Buick Riveria (G-Body), 3.8L and 3.8L Supercharged
Oldsmobile Eighty Eight (H-Body), 3.8L Supercharged
Pontiac Bonneville (H-Body), 3.8L Supercharged
Buick Regal (W-Body), 3.8L Supercharged
Chevrolet Lumina/Monte Carlo (W-Body), 3.4L V6 DOHC
Pontiac Grand Prix (W-Body), 3.8L Supercharged

POWERFLOW CHART

GEAR RATIOS
1ST = 2.92:1
2ND = 1.57:1
3RD = 1.00:1
4TH = .071:1
REV = 2.38:1



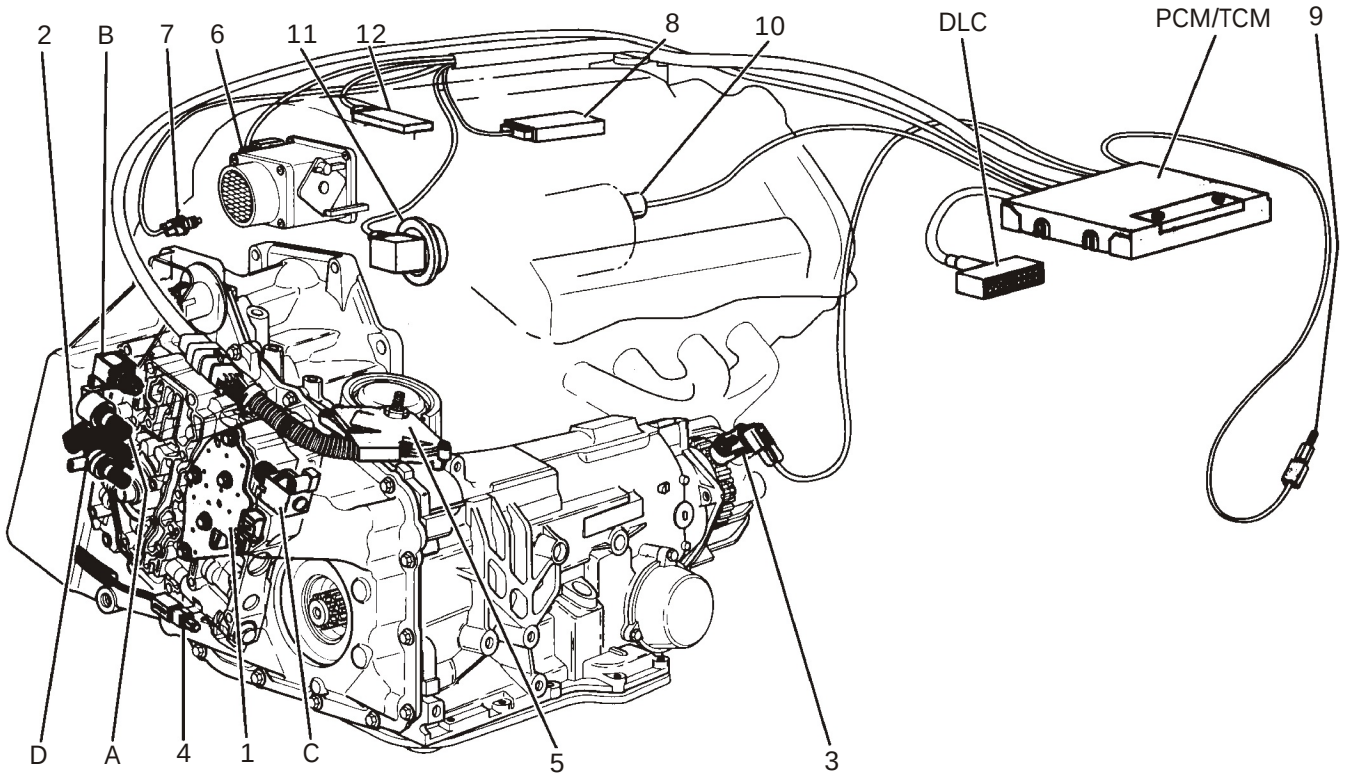
RANGE	INPUT CLUTCH	SECOND CLUTCH	THIRD CLUTCH	FOURTH CLUTCH	FORWARD BAND	D-2 BAND	REVERSE BAND	INPUT SPRAG	1-2 ROLLER	THIRD SPRAG
PARK	ON*							ON*		
REVERSE	ON						ON	HOLD		
NEUTRAL	ON*							ON*		
"D"- 1ST	ON				ON			HOLD	HOLD	
"D"- 2ND	ON*	ON			ON			F/W	HOLD	
"D"- 3RD		ON	ON		ON*			F/W	F/W	HOLD
"D"- 4TH		ON	ON*	ON	ON*			F/W	F/W	F/W
"3"- 1ST	ON				ON			HOLD	HOLD	
"3"- 2ND	ON*	ON			ON			F/W	HOLD	
"3"- 3RD	ON	ON	ON		ON*			HOLD	F/W	HOLD
"2"- 1ST	ON				ON	ON		HOLD	HOLD	
"2"- 2ND	ON*	ON			ON	ON		F/W	HOLD	
"1"- 1ST	ON		ON		ON	ON		HOLD	HOLD	HOLD

*** APPLIED BUT NOT EFFECTIVE**

Figure 2

SHIFT SOLENOID CHART			
RANGE	1-2 SHIFT SOLENOID	2-3 SHIFT SOLENOID	GEAR RATIO
PARK	ON	ON	
REVERSE	ON	ON	2.38:1
NEUTRAL	ON	ON	
1ST GEAR	ON	ON	2.92:1
2ND GEAR	OFF	ON	1.57:1
3RD GEAR	OFF	OFF	1.00:1
4TH GEAR	ON	OFF	0.71:1

GM Only Resistance Chart			
Cavities	Component	Resistance @ 68°F	Resistance @ 190°F
A-E	1-2 Shift Solenoid (A)	19-24W	24-31W
B-E	2-3 Shift Solenoid (B)	19-24W	24-31W
T-E	TCC/PWM Solenoid	10-12W	13-15W
C-D	EPC Solenoid	3-5W	5-6W
S-V	Input Speed Sensor	893-1127W	1132-1428W
M-L	TFT Sensor	3164-3867W	225-285W
	Output Speed Sensor	981-1864W	



INPUTS TO PCM/TCM

INFORMATION SENSORS

1. TFP VALVE POSITION SWITCH
2. INPUT SHAFT SPEED SENSOR (ISS)
3. VEHICLE SPEED SENSOR (VSS)
4. TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR
5. TRANSAXLE RANGE SWITCH
6. THROTTLE POSITION SENSOR (TPS)
7. ENGINE COOLANT TEMPERATURE (ECT) SENSOR
8. ENGINE SPEED SENSOR (IGNITION MODULE)
9. TCC BRAKE SWITCH
10. AIR CONDITIONING SWITCH
11. CRUISE CONTROL INFORMATION
12. MASS AIR FLOW SENSOR (MAF)

ELECTRONIC CONTROLLERS

PCM =
POWERTRAIN CONTROL MODULE

TCM =
TRANSMISSION CONTROL MODULE

DLC =
DIAGNOSTIC LINK CONNECTOR

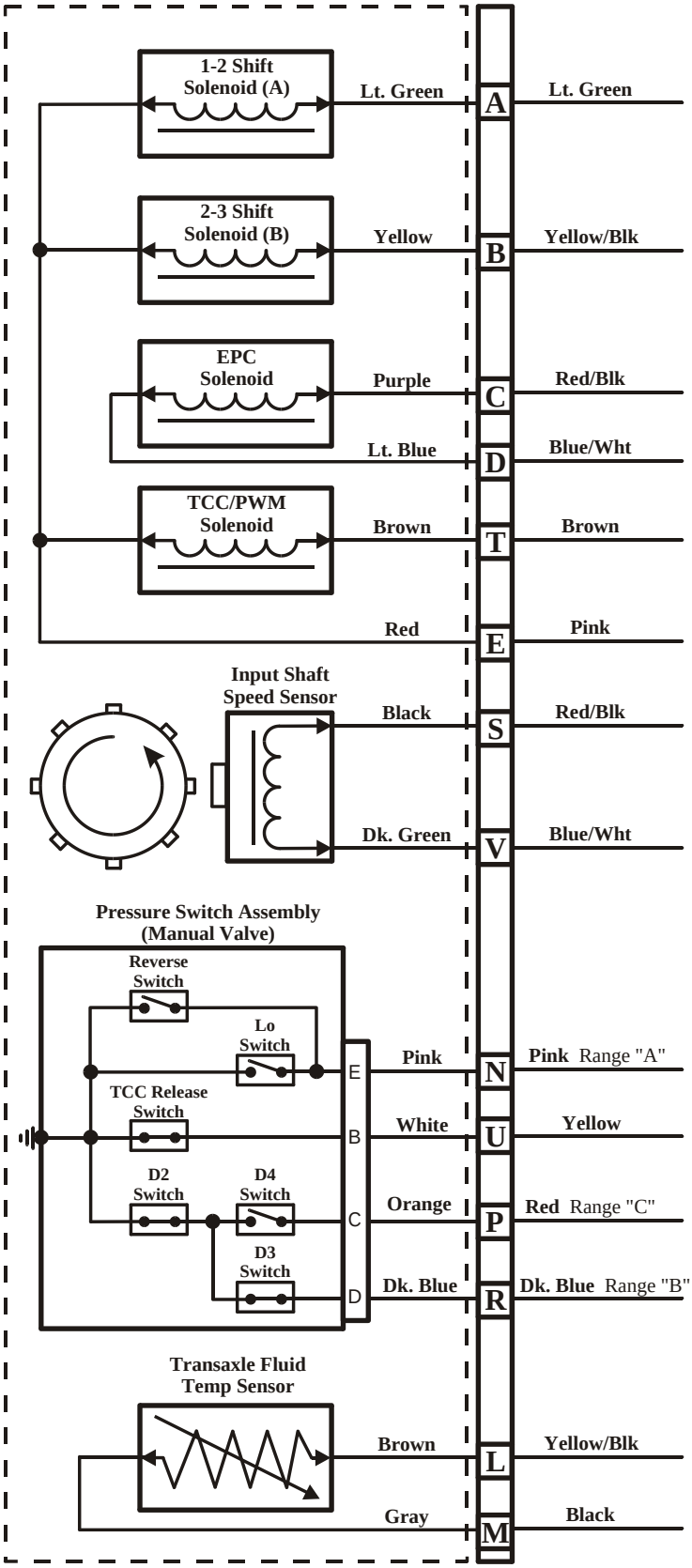
OUTPUTS TO TRANS

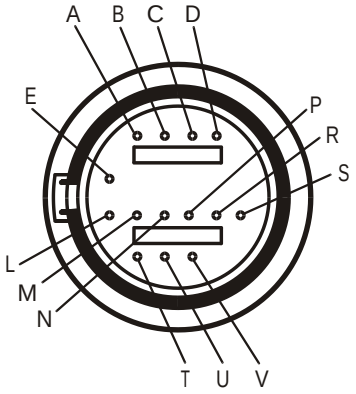
TRANSAXLE COMPONENTS

A. PRESSURE CONTROL SOLENOID
B. 1-2 SHIFT SOLENOID
C. 2-3 SHIFT SOLENOID
D. TCC/PWM SOLENOID

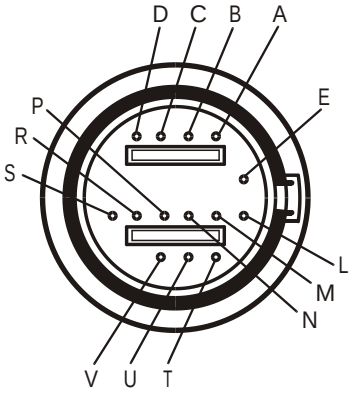
Figure 3

WIRE SCHEMATIC AND RESISTANCE CHART (GM VEHICLES)





View Looking Into Transaxle Case Connector



View Looking Into Vehicle Harness Connector

Ohms Resistance Chart			
Cavities	**Component**	**Resistance @ 68°F**	**Resistance @ 190°F**
A-E	**1-2 Shift Solenoid (A)**	**19-24W**	**24-31W**
B-E	**2-3 Shift Solenoid (B)**	**19-24W**	**24-31W**
T-E	**TCC/PWM Solenoid**	**10-12W**	**13-15W**
C-D	**EPC Solenoid**	**3-5W**	**5-6W**
S-V	**Input Speed Sensor**	**893-1127W**	**1132-1428W**
M-L	**TFT Sensor**	**3164-3867W**	**225-285W**
	Output Speed Sensor	**981-1864W**	

Figure 4

CASE CONNECTOR PIN FUNCTION (GM VEHICLES)		
Pin	**External Wire Color**	**Function**
A	**Light Green**	**Ground signal from PCM for the 1-2 Shift Solenoid (A)**
B	**Yellow/Black**	**Ground signal from PCM for the 2-3 Shift Solenoid (B)**
C	**Red/Black**	**Electronic Pressure Control Solenoid, HIGH Control**
D	**Blue/White**	**Electronic Pressure Control Solenoid, LOW Control**
E	**Pink**	**Transaxle Solenoid 12V Power In**
L	**Yellow/Black**	**Transaxle Fluid Temperature (TFT) Sensor HIGH**
M	**Black**	**Transaxle Fluid Temperature (TFT) Sensor LOW**
N	**Pink**	**Pressure Switch Assembly, Range Signal "A"**
P	**Red**	**Pressure Switch Assembly, Range Signal "C"**
R	**Dark Blue**	**Pressure Switch Assembly, Range Signal "B"**
S	**Red/Black**	**Input Speed Sensor (ISS) signal HIGH**
T	**Brown**	**Ground signal from PCM for the TCC/PWM Converter Clutch Solenoid**
U	**Yellow**	**TCC Release Switch signal to the PCM**
V	**Blue/White**	**Input Speed Sensor (ISS) signal LOW**

Figure 5

TRANSAXLE INTERNAL ELECTRONIC COMPONENTS

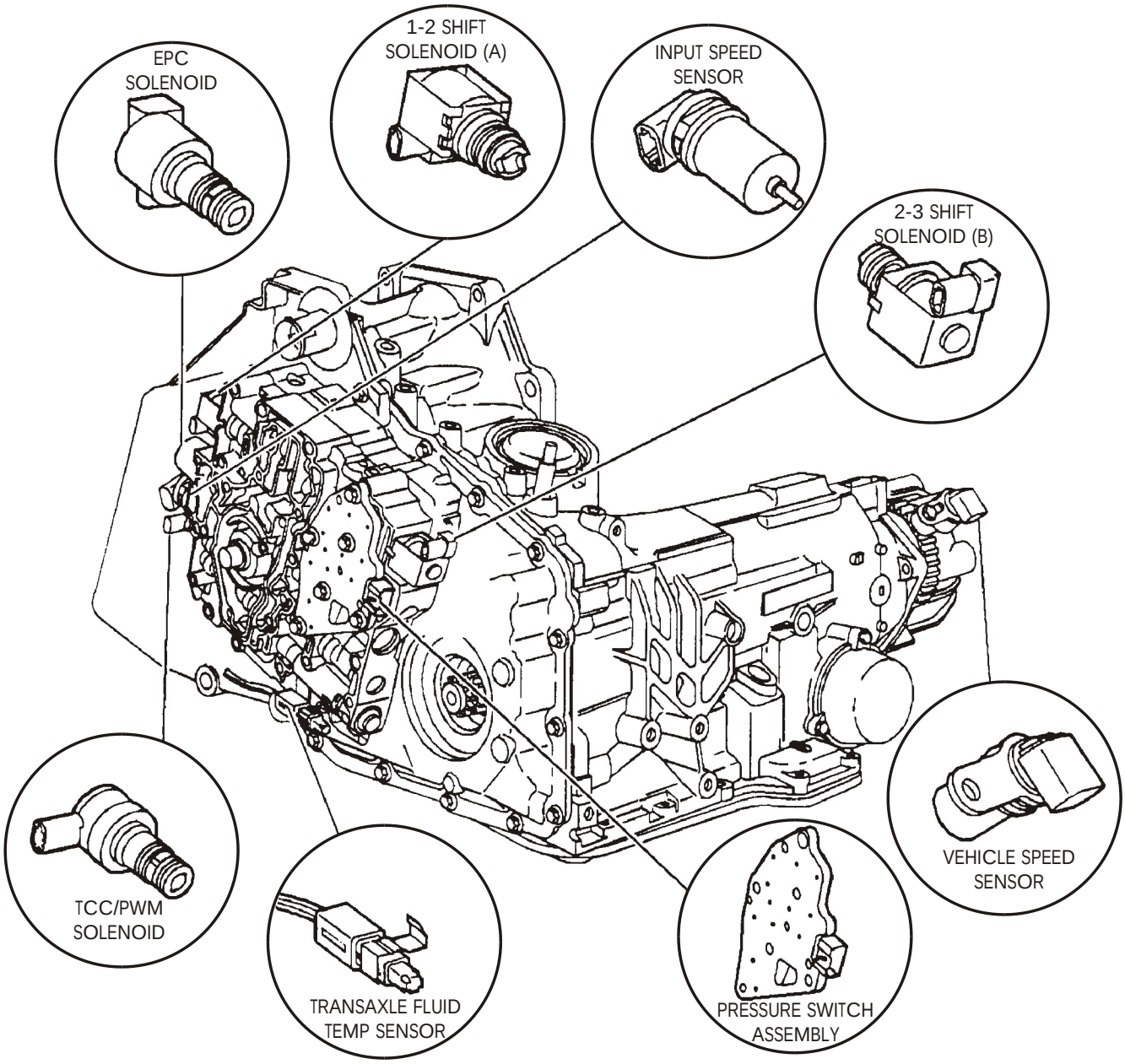


Figure 6

GM DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION			
DTC	**DESCRIPTION**	**DTC TYPE***	**DEFAULT ACTION**
P0218	Automatic Transmission Fluid Overtemperature	D	1 DTC P0218 is stored in PCM memory 2 Disable shift adapts
P0502	Vehicle Speed Sensor Circuit Low Input	B	1 DTC P0502 is stored in PCM memory 2 Maximum line pressure 3 Disable shift adapts 4 Calculate VSS from ISS and commanded gear
P0503	Vehicle Speed Sensor Circuit Performance	B	1 DTC P0503 is stored in PCM memory 2 Maximum line pressure 3 Disable shift adapts 4 Calculate VSS from ISS and commanded gear
P0560	System Voltage Malfunction	D	1 DTC P0560 is stored in PCM memory 2 Disable shift adapts 3 Inhibit TCC
P0711	Automatic Transmission Fluid Temperature Sensor Circuit Performance	B	1 DTC P0711 is stored in PCM memory 2 Disable shift adapts 3 The PCM calculates a default TFT from the ECT and IAT
P0712	Automatic Transmission Fluid Temperature Sensor Circuit Low Input	D	1 DTC P0712 is stored in PCM memory 2 Disable shift adapts 3 The PCM calculates a default TFT from the ECT and IAT
P0713	Automatic Transmission Fluid Temperature Sensor Circuit High Input	D	1 DTC P0713 is stored in PCM memory 2 Disable shift adapts 3 The PCM calculates a default TFT from the ECT and IAT
P0716	Automatic Transmission Input Speed Sensor Circuit Performance	B	1 DTC P0716 is stored in PCM memory 2 Disable shift adapts
P0717	Automatic Transmission Input Speed Sensor Circuit No Signal	B	1 DTC P0717 is stored in PCM memory 2 Disable shift adapts

***DTC TYPES**

A - Emission-related, turns the MIL "ON" after the 1st failure.

B - Emission-related, turns the MIL "ON" after two consecutive trips with failure.

D - Non-emission-related, no lamps and no message.

Figure 7

GM DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION			
DTC	**DESCRIPTION**	**DTC TYPE***	**DEFAULT ACTION**
P0719	TCC Brake Switch Circuit Low	D	1 DTC P0719 is stored in PCM memory 2 Disregards brake switch input for TCC operation under the following conditions a. Throttle position greater than 6% b. Vehicle speed is greater than 44 MPH c. Throttle position was previously greater than 12% while the vehicle speed was greater than 47 MPH d. Brake switch has not been OFF for more than 2 seconds in this ignition cycle
P0724	TCC Brake Switch Circuit High	D	1 DTC P0724 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure
P0730	Undefined Gear Ratio	D	1 DTC P0730 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure
P0741	Torque Converter Clutch System Stuck OFF	B	1 DTC P0741 is stored in PCM memory 2 Disable shift adapts 3 Inhibits TCC 4 Inhibits 4th gear in Hot Mode
P0742	Torque Converter Clutch System Stuck ON	A	1 DTC P0742 is stored in PCM memory 2 Disable shift adapts 3 TCC commanded ON at maximum capacity
P0748	Pressure Control Solenoid Electrical	D	1 DTC P0748 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure
P0751	1-2 Shift Solenoid Performance	B	1 DTC P0751 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure 4 Inhibits 3-2 downshifts when the vehicle speed is greater than 30 MPH
P0753	1-2 Shift Solenoid Electrical	A	1 DTC P0753 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure 4 Inhibits 3-2 downshifts when the vehicle speed is greater than 30 MPH

***DTC TYPES**

A - Emission-related, turns the MIL "ON" after the 1st failure.

B - Emission-related, turns the MIL "ON" after two consecutive trips with failure.

D - Non-emission-related, no lamps and no message.

Figure 8

GM DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION			
DTC	**DESCRIPTION**	**DTC TYPE***	**DEFAULT ACTION**
P0756	2-3 Shift Solenoid Performance	A	1 DTC P0756 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure 4 Defaults to 3rd gear 5 Inhibits TCC
P0758	2-3 Shift Solenoid Electrical	A	1 DTC P0758 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure 4 Defaults to 3rd gear 5 Inhibits TCC
P1810	Automatic Transmission Fluid Pressure Manual Valve Position Switch Circuit Malfunction	B	1 DTC P1810 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure 4 PCM assumes D4 for shifting
P1811	Maximum Adapt and Long Shift	D	1 DTC P1811 is stored in PCM memory 2 Disable shift adapts 3 Maximum line pressure
P1860	Torque Converter Clutch Pulse Width Modulation Solenoid Electrical	A	1 DTC P1860 is stored in PCM memory 2 Disable shift adapts 3 Inhibits TCC 4 Inhibits 4th gear in Hot Mode
P1887	Torque Converter Clutch Release Switch Circuit Malfunction	B	1 DTC P1887 is stored in PCM memory 2 Disable shift adapts 3 Inhibits TCC 4 Inhibits 4th gear in Hot Mode

***DTC TYPES**

A - Emission-related, turns the MIL "ON" after the 1st failure.

B - Emission-related, turns the MIL "ON" after two consecutive trips with failure.

D - Non-emission-related, no lamps and no message.

Figure 9

THM 4T65E

1997-2004 GEAR RATIO IDENTIFICATION

This is the latest information that is available for the THM 4T65E transaxle to identify the transaxle as to which vehicle it is compatible with, and both sprocket ratios and final drive ratios are provided by model. Notice also that we have provided converter codes for both the 245mm and 258mm and the "K" factor for the converters, which determines stall speeds. We have also included which models have the Internal Mode Switch (IMS) and which models do not require the internal IMS.

SPECIAL NOTE:

Keep in mind that this information may change at any time.

Figure 10 gives you information on the 1997 models.

Figure 11 gives you information on the 1998 models.

Figure 12 gives you information on the 1999 models.

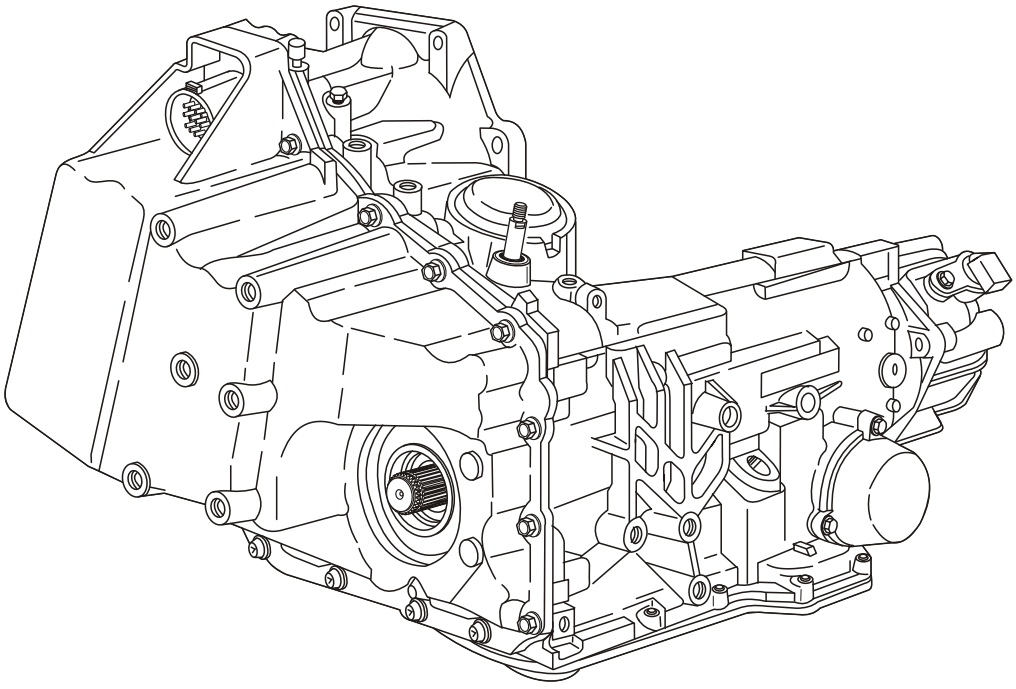
Figure 13 gives you information on the 2000 models.

Figure 14 gives you information on the 2001 models.

Figure 15 gives you information on the 2002 models.

Figure 16 gives you information on the 2003 models.

Figure 17 gives you information on the 2004 models.



1997 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
7BDB	*"C", "G"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*N*
7BMB	*"G"*	*3.8L - Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
7FBB	*"G"*	*3.8L - Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
7FHB	*"C", "G"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*N*
7HKB	*"W"*	*3.8L - Supercharged /Buick, Pont*	*3.29*	*37/33*	*JTFM*	*258mm*	*155*	*N*
7MAB	*"H"*	*3.8L - Supercharged /Olds, Pont*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
7XAB	*"W"*	*3.8L - Supercharged /Buick, Pont*	*3.29*	*37/33*	*JTFM*	*258mm*	*155*	*N*
7YSB	*"W"*	*3.4L, /Chevrolet*	*3.05*	*33/37*	*FJHB*	*245mm*	*177*	*N*
7YWB	*"H"*	*3.8L - Supercharged /Olds, Pont*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal

Note: 4th VIN Digit = Body Code For Cars.

Figure 10

1998 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
8FCB	*"C", "G"*	*3.8L - Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
8FDB	*"H"*	*3.8L - Supercharged /Olds, Pont*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
8FFB	*"C"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*N*
8KAB	*"W"*	*3.8L, /Chev, Police/Taxi*	*3.29*	*35/35*	*FLHB*	*245mm*	*163*	*N*
8THB	*"W"*	*3.8L, /Chev, Pont*	*3.29*	*35/35*	*FLHB*	*245mm*	*163*	*N*
8TNB	*"W"*	*3.8L, /Buick*	*3.05*	*35/35*	*FLHB*	*245mm*	*163*	*N*
8TPB	*"H"*	*3.8L, /Buick, Olds, Pont*	*3.05*	*35/35*	*FLHB*	*245mm*	*163*	*N*
8XAB	*"W"*	*3.8L - Supercharged /Buick, Pont*	*3.29*	*37/33*	*JTFM*	*258mm*	*155*	*N*
8YCB	*"W"*	*3.5L, /Oldsmobile*	*3.29*	*35/35*	*JXFM*	*258mm*	*164*	*N*
8YFB	*"H"*	*3.8L, /Buick, Olds, Pont*	*2.86*	*35/35*	*JSFM*	*258mm*	*133*	*N*

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal

Note: 4th VIN Digit = Body Code For Cars.

Figure 11

1999 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
9APB	*"W"*	*3.8L, /Buick*	*3.05*	*35/35*	*JZFM*	*258mm*	*???*	*N*
9BCB	*"U"*	*3.4L, /Chev, Pont, Olds*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9BCB	*"W"*	*3.8L, /Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9CMB	*"G"*	*3.8L - Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
9CRB	*"W"*	*3.8L, /Oldsmobile*	*3.05*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9FAB	*"W"*	*2.5L, /Buick (China)*	*3.29*	*33/37*	*FDHB*	*245mm*	*180*	*N*
9FCB	*"C"*	*3.8L - Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*Y*
9FDB	*"H"*	*3.8L - Supercharged /Olds, Pont*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*N*
9FFB	*"C"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
9FMB	*"W"*	*3.0L, /Buick (China)*	*3.29*	*35/35*	*FDHB*	*245mm*	*180*	*N*
9KAB	*"W"*	*3.8L, /Chevrolet, Police/Taxi*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9THB	*"W"*	*3.8L, /Chevrolet,*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9TNB	*"H"*	*3.8L, /Buick, Olds, Pont*	*3.05*	*35/35*	*FLQB*	*245mm*	*163*	*N*
9XAB	*"W"*	*3.8L - Supercharged /Buick, Pont*	*3.29*	*37/33*	*JTFM*	*258mm*	*155*	*N*
9YCB	*"W"*	*3.5L, /Oldsmobile*	*3.29*	*35/35*	*JSFM*	*258mm*	*133*	*N*
9YFB	*"H"*	*3.8L, /Buick, Olds, Pont*	*2.86*	*35/35*	*FLQB*	*245mm*	*163*	*N*

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal

Note: 4th VIN Digit = Body Code For Cars.

Figure 12

2000 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
0APB, 0ARB	"W"	3.8L, /Buick	3.05	35/35	JZFM	258mm	R115	N
0BCB, 0BRB	"U"	3.4L, /Chev, Olds, Pont	3.29	35/35	FLQB	245mm	163	N
0BCB, 0BRB	"W"	3.8L, /Buick	3.29	35/35	FLQB	245mm	163	N
0FHB, 0CHB	"H"	3.8L, Supercharged /Pontiac	3.29	37/33	JZFM	258mm	R115	Y
0FCB, 0FDB	"C"	3.8L, Supercharged /Buick	3.29	37/33	JSFM	258mm	133	Y
0FFB, 0FKB	"C"	3.8L, /Buick	3.05	35/35	JSFM	258mm	133	Y
0LDB, 0LMB	"W"	3.8L, /Chevrolet	3.29	35/35	FLQB	245mm	163	Y
0LCB, 0LNB	"W"	3.8L, /Chevrolet - Police/Taxi	3.29	35/35	FLQB	245mm	163	Y
0LBB, 0LPB	"W"	3.8L, /Chevrolet	3.05	35/35	FLQB	245mm	163	Y
0PBB, 0PCB	"H"	3.8L, /Buick, Pont	3.05	35/35	JZFM	258mm	R115	Y
0PAB, 0PPB	"H"	3.8L, /Buick, Pont	2.86	35/35	JSFM	258mm	133	Y
0RDB, 0RLB	"W"	3.4L, /Chevrolet	2.86	35/35	FDQB	245mm	180	Y
0RNB, 0RWB	"W"	3.1L, /Buick, Chev, Pont	3.05	35/35	FDHB	245mm	180	N
0XAB, 0XBB	"W"	3.8L, Supercharged /Buick, Pont	3.29	37/33	JTFM	258mm	155	N
0YCB, 0YHB	"W"	3.5L, /Oldsmobile	3.29	35/35	JXFM	258mm	164	N
0YMB, 0YRB	"W"	3.5L, /Oldsmobile	3.05	35/35	JXFM	258mm	164	N

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal, Impala

Note: 4th VIN Digit = Body Code For Cars.

Figure 13

2001 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
1APB	"W"	3.8L, /Buick	3.05	35/35	JZFM	258mm	R115	N
1BCB	"U"	3.4L, /Chev, Olds, Pont	3.29	35/35	FLQB	245mm	163	N
1BCB	"W"	3.8L, /Pontiac	3.29	35/35	FLQB	245mm	163	N
1BCB	"B"	3.4L, /Pontiac (2WD)	3.29	35/35	FLQB	245mm	163	N
1CHB	"H"	3.8L, Supercharged /Pontiac	3.29	37/33	JZFM	258mm	R115	Y
1CXB	"B"	3.4L, /Pontiac (AWD)	3.29	35/35	FLQB	245mm	163	N
1DCB	"G"	3.5L, /Oldsmobile	3.29	35/35	JXFM	258mm	164	Y
1FCB	"C"	3.8L, Supercharged /Buick	3.29	37/33	JSFM	258mm	133	Y
1FCB	"H"	3.8L, Supercharged /Pontiac	3.29	37/33	JSFM	258mm	133	Y
1FFB	"C"	3.8L, /Buick	3.05	35/35	JSFM	258mm	133	Y
1LBB	"W"	3.8L, /Chevrolet	3.05	35/35	FLQB	245mm	163	Y
1LCB	"W"	3.8L, /Chevrolet - Police/Taxi	3.29	35/35	FLQB	245mm	163	Y
1LDB	"W"	3.8L, /Chevrolet	3.29	35/35	FLQB	245mm	163	Y
1PAB	"H"	3.8L, /Buick, Pont	2.86	35/35	JSFM	258mm	133	Y
1PBB	"H"	3.8L, /Buick, Pont	3.05	35/35	JZFM	258mm	R115	Y
1RDB	"W"	3.4L, /Chevrolet	2.86	35/35	FDHB	245mm	180	Y
1RNB	"W"	3.1L, /Buick, Pont	3.05	35/35	FDHB	245mm	180	N
1XAB	"W"	3.8L, Supercharged /Buick, Pont	3.29	37/33	JTFM	258mm	155	N
1YCB	"W"	3.5L, /Oldsmobile	3.29	35/35	JXFM	258mm	164	N
1YMB	"W"	3.5L, /Oldsmobile	3.05	35/35	JXFM	258mm	164	N

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal, Impala

Note: 4th VIN Digit = Body Code For Cars.

Figure 14

2002 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
2APB	*"W"*	*3.8L, /Buick*	*3.05*	*35/35*	*JZFM*	*258mm*	*R115*	*N*
2BCB	*"U"*	*3.4L, /Chev, Olds, Pont*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
2BCB	*"W"*	*3.8L, /Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
2BCB	*"B"*	*3.4L, /Buick, Pontiac (2WD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
2CHB	*"H"*	*3.8L, Supercharged /Pontiac*	*3.29*	*37/33*	*JZFM*	*258mm*	*R115*	*Y*
2CXB	*"B"*	*3.4L, /Buick, Pontiac (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
2CXB	*"U"*	*3.4L, /Chev, Olds, Pont (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
2DCB	*"G"*	*3.5L, /Oldsmobile*	*3.29*	*35/35*	*JXFM*	*258mm*	*164*	*Y*
2FCB	*"C"*	*3.8L, Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*Y*
2FFB	*"C"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
2KLB	*"W"*	*3.7L, /Chevrolet*	*3.29*	*33/37*	*N/A*	*258mm*	*179*	*Y*
2LBB	*"W"*	*3.8L, /Chevrolet*	*3.05*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
2LCB	*"W"*	*3.8L, /Chevrolet - Police/Taxi*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
2PAB	*"H"*	*3.8L, /Buick, Pont*	*2.86*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
2PBB	*"H"*	*3.8L, /Pontiac*	*3.05*	*35/35*	*JZFM*	*258mm*	*R115*	*Y*
2RDB	*"W"*	*3.4L, /Chevrolet*	*2.86*	*35/35*	*FDHB*	*245mm*	*180*	*Y*
2RNB	*"W"*	*3.1L, /Buick, Pont*	*3.05*	*35/35*	*FDHB*	*245mm*	*180*	*N*
2YCB	*"W"*	*3.5L, /Oldsmobile*	*3.29*	*35/35*	*JXFM*	*258mm*	*164*	*N*
2YMB	*"W"*	*3.5L, /Oldsmobile*	*3.05*	*35/35*	*JXFM*	*258mm*	*164*	*N*

"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal, Impala

Note: 4th VIN Digit = Body Code For Cars.

Figure 15

2003 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
3BCB	*"U"*	*3.4L, /Chevrolet, Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
3BCB	*"B"*	*3.4L, /Pontiac (2WD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
3CHB	*"H"*	*3.8L, Supercharged /Pontiac*	*3.29*	*37/33*	*JZFM*	*258mm*	*R115*	*Y*
3CXB	*"B"*	*3.4L, /Pontiac (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
3CXB	*"U"*	*3.4L, /Pontiac (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
3FCB	*"C"*	*3.8L, Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*Y*
3FFB	*"C"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
3LBB	*"W"*	*3.8L, /Chevrolet, Buick*	*3.05*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
3LCB	*"W"*	*3.8L, /Chevrolet - Police/Taxi*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
3LDB	*"W"*	*3.8L, /Chevrolet, Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
3PAB	*"H"*	*3.8L, /Buick, Pontiac*	*2.86*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
3PBB	*"H"*	*3.8L, /Buick, Pontiac*	*3.05*	*35/35*	*JZFM*	*258mm*	*R115*	*Y*
3RDB	*"W"*	*3.4L, /Chevrolet*	*2.86*	*35/35*	*FDHB*	*245mm*	*180*	*Y*
3RNB	*"W"*	*3.1L, /Buick, Pontiac*	*3.05*	*35/35*	*FDHB*	*245mm*	*180*	*N*
3XAB	*"W"*	*3.8L, /Supercharged Buick, Pontiac*	*3.29*	*37/33*	*JTFM*	*258mm*	*155*	*N*

"B" Body = Caprice
"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal, Impala

Note: 4th VIN Digit = Body Code For Cars.

Figure 16

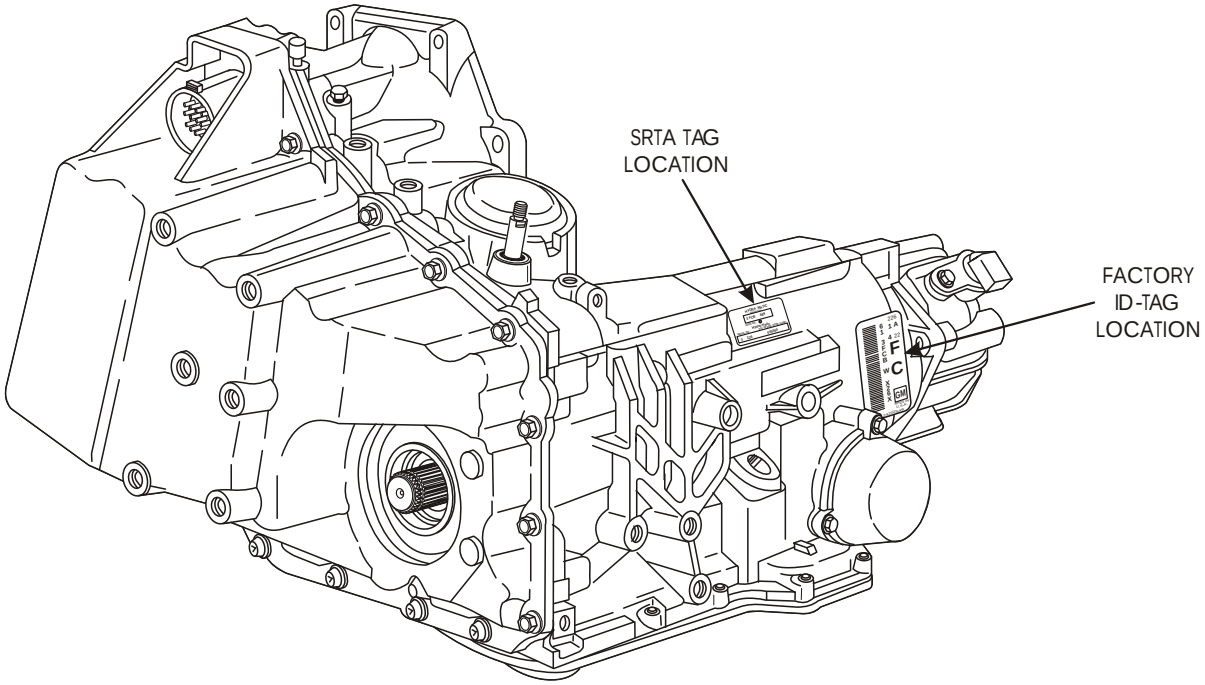
2004 THM 4T65E MODELS								
MODEL CODE	BODY	ENGINE/CAR LINE	F/D RATIO	SPRKTS DRVE/DRVN	CONV CODE	CONV DIAM	"K" FCTR	IMS Y/N
4BCB	*"U"*	*3.4L, /Chevrolet, Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
4BCB	*"B"*	*3.4L, /Buick, Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
4CAB	"W"	*3.8L, 3.8L Supercharged /Pont, Chev*	*3.29*	*37/33*	*JZFM*	*258mm*	*R115*	*Y*
4CBB	"W"	*3.8L, /Pontiac*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
4CXB	*"U"*	*3.4L, /Chevrolet, Pontiac (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
4CXB	*"B"*	*3.4L, /Chevrolet, Pontiac (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*
4FCB	*"C"*	*3.8L, Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*Y*
4FFB	*"C"*	*3.8L, /Buick*	*3.05*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
4KNB	"W"	*3.8L, Supercharged /Buick*	*3.29*	*37/33*	*JSFM*	*258mm*	*133*	*Y*
4LBB	"W"	*3.8L, /Chevrolet, Buick, Pontiac*	*3.05*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
4LCB	"W"	*3.8L, /Chevrolet - Police/Taxi*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
4LDB	"W"	*3.8L, /Chevrolet,*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
4PAB	*"H"*	*3.8L, /Buick, Pontiac*	*2.86*	*35/35*	*JSFM*	*258mm*	*133*	*Y*
4PBB	*"H"*	*3.8L, /Pontiac*	*3.05*	*35/35*	*JZFM*	*258mm*	*R115*	*Y*
4RDB	"W"	*3.4L, /Chevrolet*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*Y*
4RNB	"W"	*3.1L, /Buick, Pont*	*3.05*	*35/35*	*FDHB*	*245mm*	*180*	*N*
4VCB	*"B"*	*3.6L, /Buick (AWD)*	*3.29*	*35/35*	*FLQB*	*245mm*	*163*	*N*

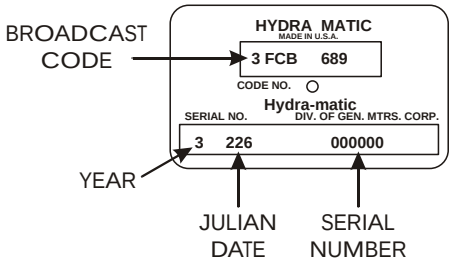
"B" Body = Caprice
"C" Body = Park Avenue/Ultra
"G" Body = Aurora, Riviera
"H" Body = Bonneville, Eighty Eight, LeSabre
"U" Body = Venture, Silhouette, Trans Sport
"W" Body = Grand Prix, Intrigue, Lumina, Century, Monte Carlo, Regal, Impala

Note: 4th VIN Digit = Body Code For Cars.

Figure 17

IDENTIFICATION TAG LOCATIONS FOR BROADCAST CODE





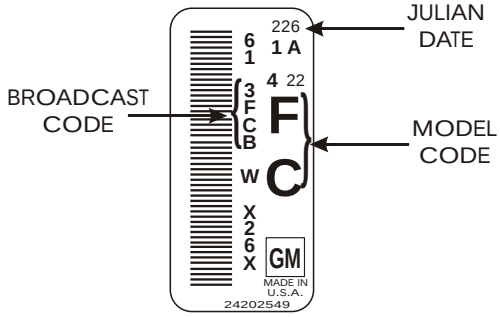
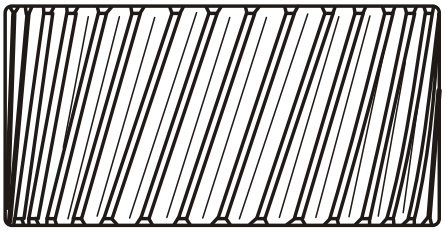


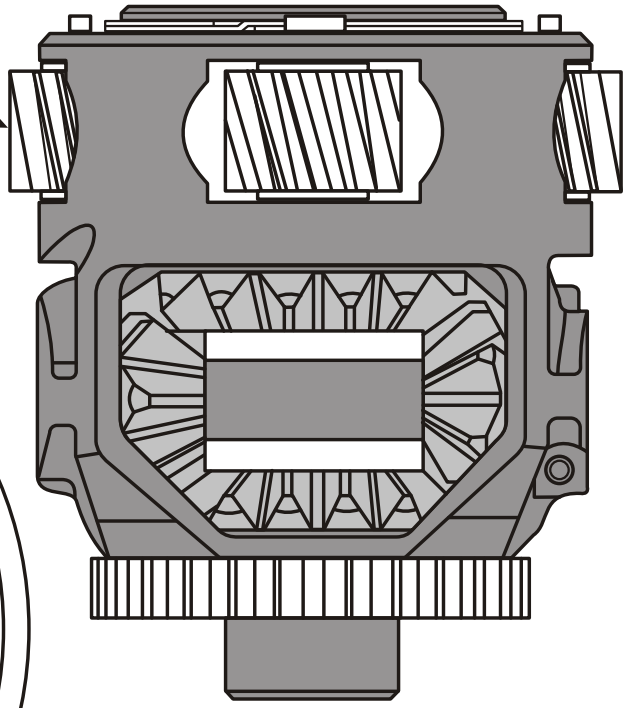
Figure 18

"1997-UP FINE PITCH" FINAL DRIVE IDENTIFICATION

DIRECTION OF PITCH



2.86 = 18 Teeth
3.05 = 20 Teeth
3.29 = 22 Teeth



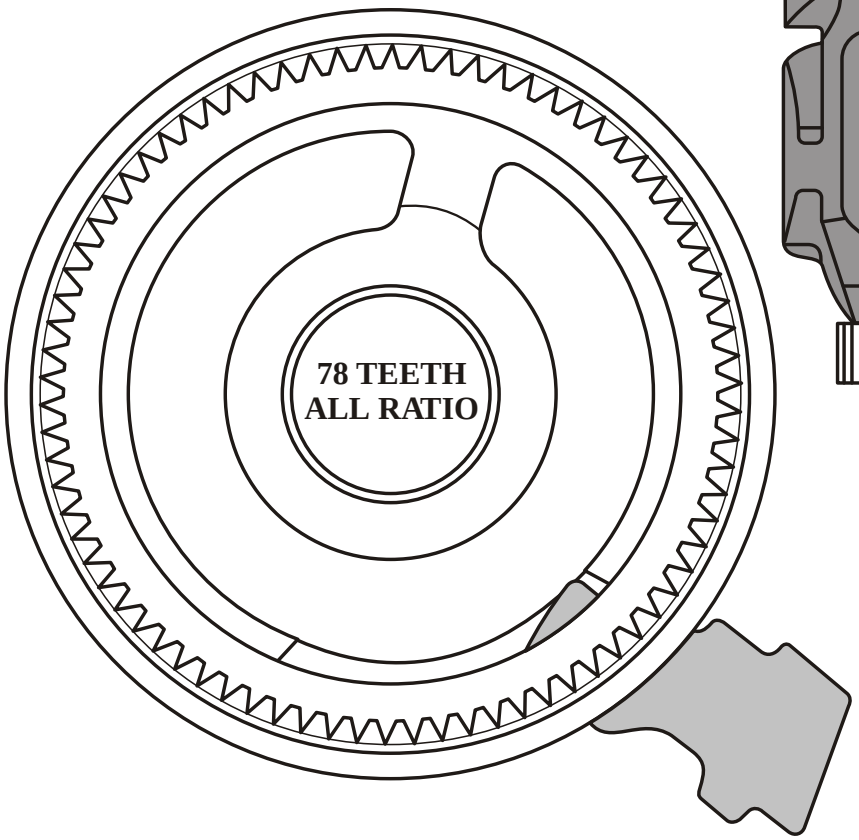
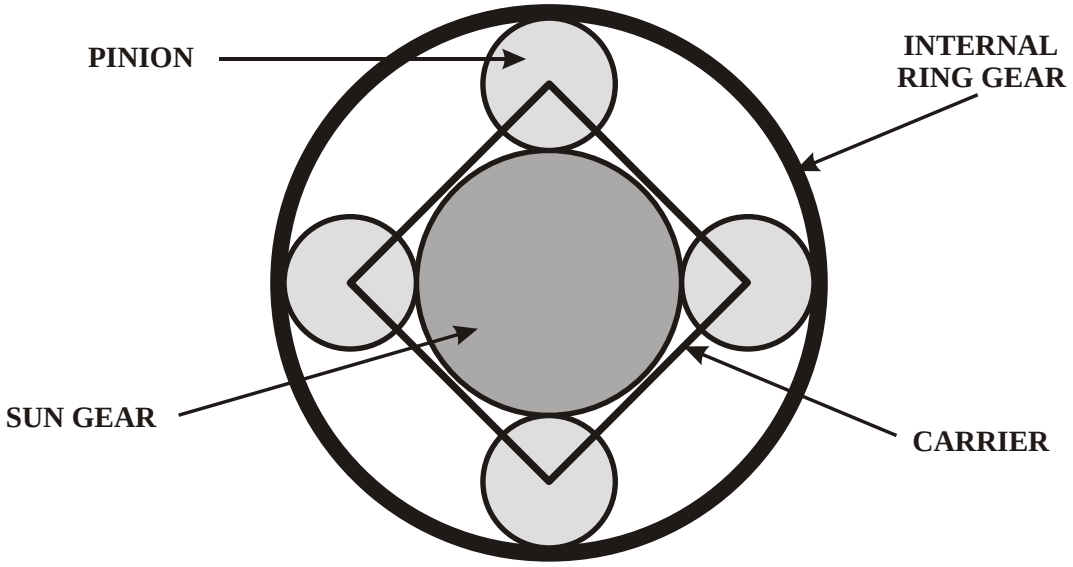


Figure 19

FORMULA FOR FINAL DRIVE RATIO IDENTIFICATION



I = NUMBER OF TEETH ON INTERNAL RING GEAR
S = NUMBER OF TEETH ON SUN GEAR
P = NUMBER OF TEETH ON PINION GEAR

HELD	INPUT	OUTPUT	REVOLUTIONS SUN	REVOLUTIONS CARRIER	REVOLUTIONS INTERNAL	REVOLUTIONS PINION
INTERNAL	SUN	CARRIER	1	$\frac{I + S}{S}$	0	$\left(\frac{S}{I + S}\right)\left(\frac{I}{P}\right)$

Fine Pitch Example: $\frac{\mathbf{I = 78 + S = 34}}{\mathbf{S = 34}} = \frac{\mathbf{112}}{\mathbf{34}} = \mathbf{3.29}$

Regular Pitch Example: $\frac{\mathbf{I = 70 + S = 38}}{\mathbf{S = 38}} = \frac{\mathbf{108}}{\mathbf{38}} = \mathbf{2.84}$

Figure 20

THM 4T65-E
DRIVEN SPROCKET SUPPORT AND SEALING RING CHANGES

CHANGE: During the 1998 model year, and implemented as a running change, GM Powertrain eliminated the rubber "Quad-Ring" that was used as an expander for the Vespel sealing rings on the driven sprocket support, as shown in Figure 21. There was also a change of material for the sealing rings that occured at the same time. "Vespel" material was eliminated, and "Peak" material was implemented, as shown in Figure 21.

REASON: Ease of assembly, and cost reduction.

PARTS AFFECTED:

(1) RUBBER QUAD-RING - The rubber quad-ring, that was used in the seal groove under the "Vespel" seal ring as an expander, was eliminated (See Figure 21).

(2) VESPEL SEALING RINGS - The Vespel material sealing rings were replaced with a "Peak" material at the same time (See Figure 21). The "Vespel" seal rings are Brown in color, and the "Peak" seal rings are Black in color.

(3) DRIVEN SPROCKET SUPPORT - The seal ring grooves were not machined as deep on the second design sprocket support, to accommodate the new design seal rings without the rubber quad rings. The groove depth on 1st design is approximately .155", and groove depth on the 2nd design is approximately .115". Refer to Figure 21.

INTERCHANGEABILITY:

The second design driven sprocket support and the "Peak" 2nd clutch sealing rings will back service ***all*** previous models of the 4T65-E.
The first design driven sprocket support ***must*** be used with the rubber quad-rings.

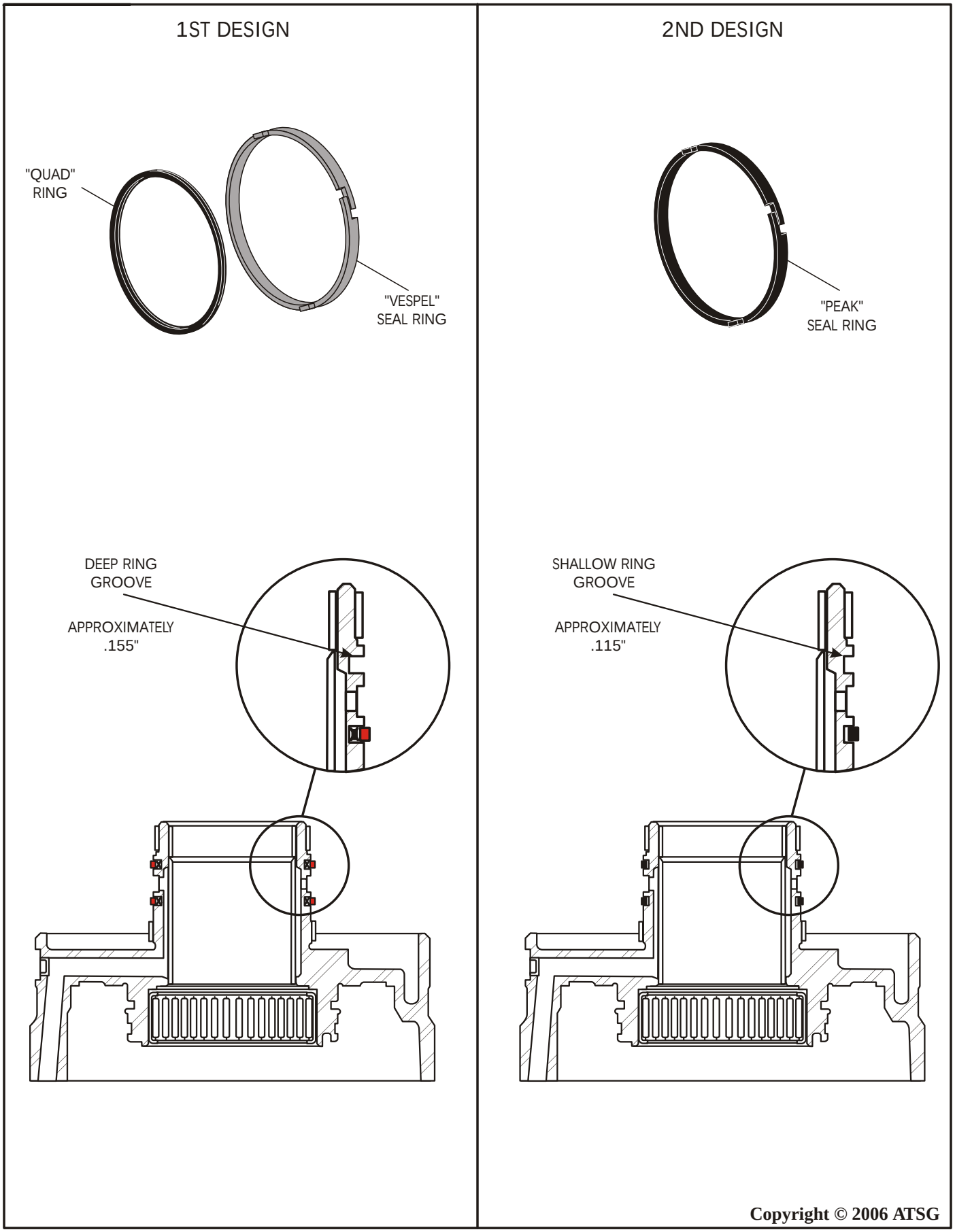


Figure 21

THM 4T65-E
REVERSE REACTION DRUM CHANGE

CHANGE: Beginning approximately mid-way through the 1997 model years production, the Reverse Reaction Drum received some very slight dimensional changes to the slots, this also affected the 2nd clutch housing splines, where the two mate together.

REASON: To help eliminate "peening" of the reverse reaction drum and the 2nd clutch drum.

PARTS AFFECTED:

(1) REVERSE REACTION DRUM - Received some very slight dimensional changes on the splined end that enters the 2nd clutch housing. The sides of the slots that spline into the 2nd clutch housing were machined straight, as shown in Figure 22, and can be easily identified with the round holes stamped in the drum, as shown in Figure 23.

(2) 2ND CLUTCH HOUSING - Received some very slight dimensional changes on the internal splines, where the reverse reaction drum mates with the 2nd clutch housing. The sides of the splines in the 2nd clutch housing were machined straight, to accommodate the revised slots in the reverse reaction drum, as shown in Figure 22. There are no other means of identification on the 2nd clutch housing.

INTERCHANGEABILITY:

The late style reverse reaction drum with the round holes and straight cut slots, ***will not*** fit into the early style 2nd clutch housing.
The early style reverse reaction drum with the regtangular holes and angle cut slots, ***will*** fit into the late style 2nd clutch housing, but may create a "rattle" in 1st gear that goes away on the 1-2 shift, and ***will*** wear in a very short period of time. ***"Not a recommended procedure".***

SERVICE INFORMATION:

There is a Service Package that includes both parts, and is available from GM, under OEM part number 24213402

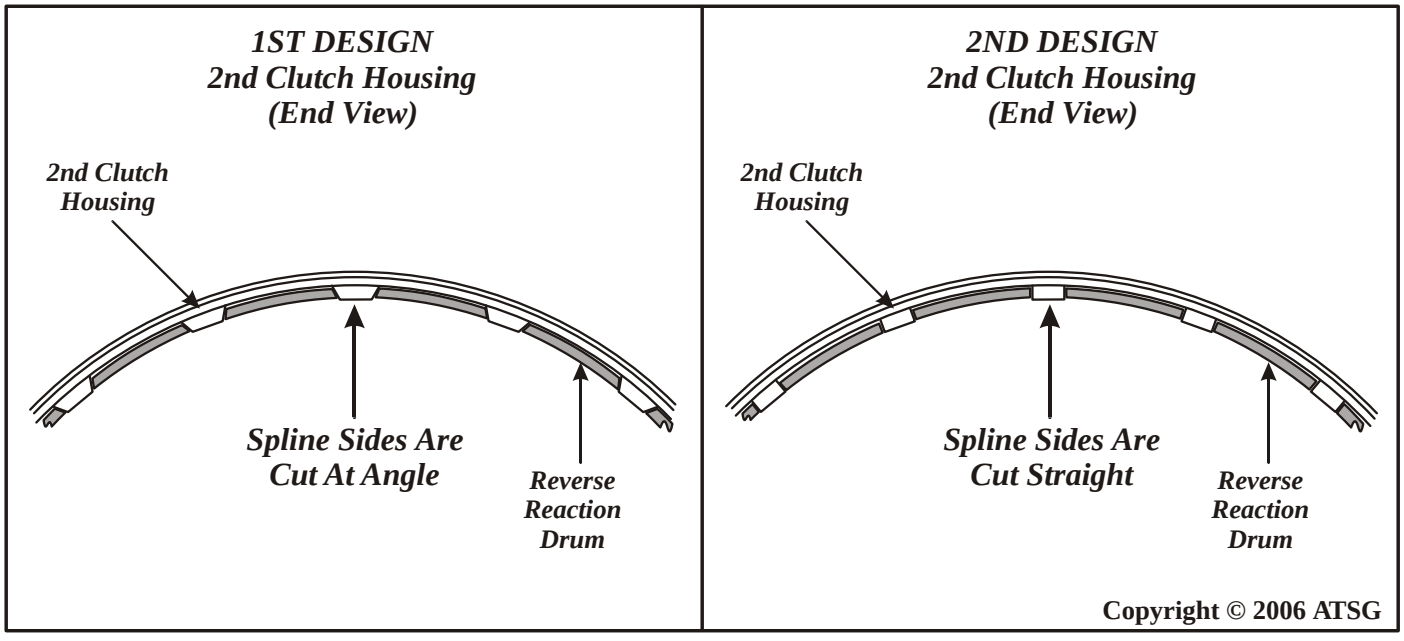


Figure 22

2ND CLUTCH HOUSING AND REVERSE REACTION DRUM

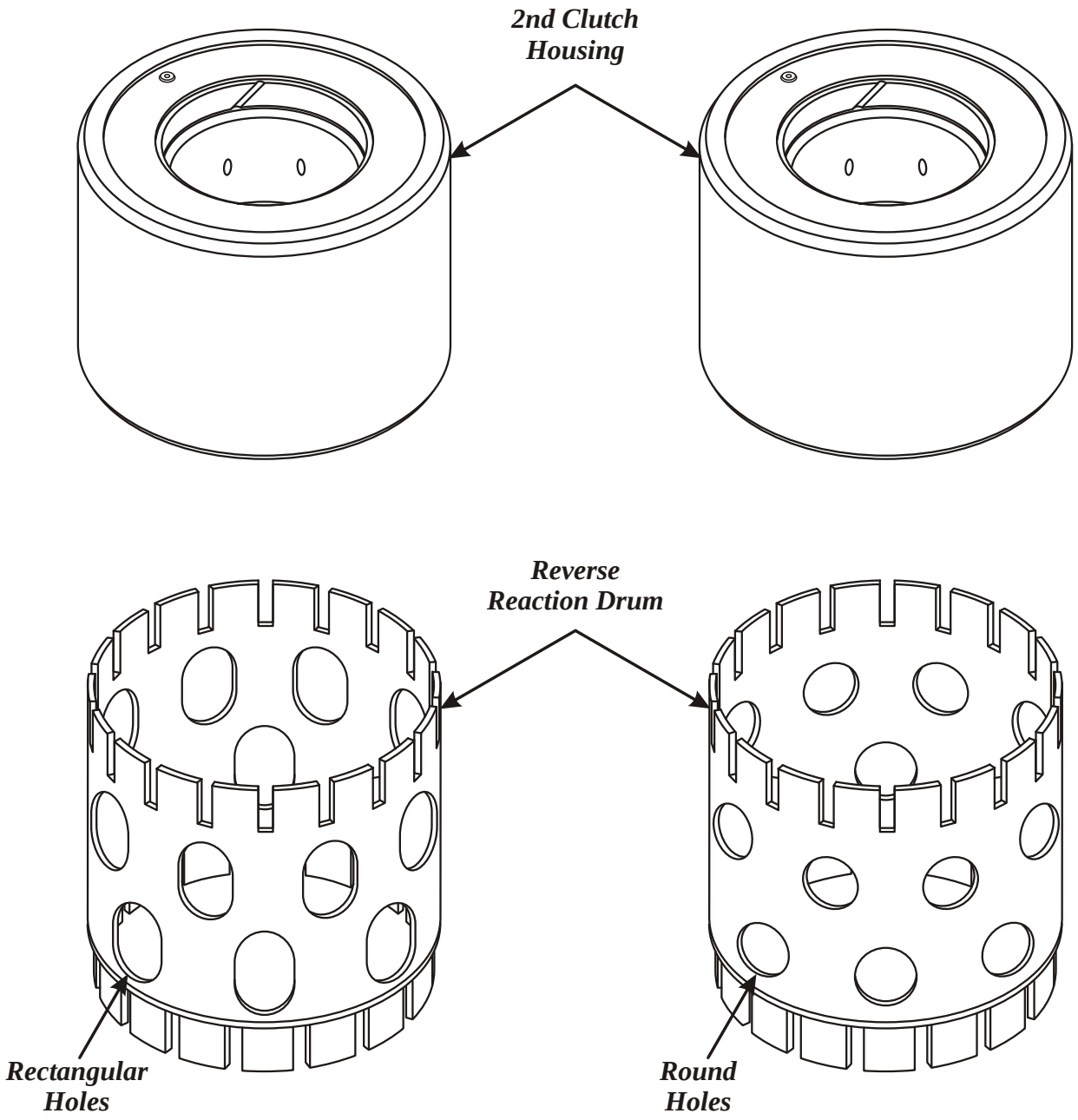


Figure 23

THM 4T65-E

SHUDDER ON TAKE OFF, SOFT 1-2 SHIFT OR DELAY TO REVERSE (MAY STORE DTC 1811)

COMPLAINT: Some General Motors vehicles equipped with the THM 4T65-E transaxle, may exhibit a shudder on take off, a soft 1-2 upshift and/or a delay when the selector lever is placed into reverse. These conditions may also set Diagnostic Trouble Code 1811, which is "Maximum Adapt" and "Long Shift".

CAUSE: The cause may be, a defective Pressure Control Solenoid (PCS), and/or a worn line boost valve and sleeve assembly in the valve body, creating less than desired line pressure rise.

CORRECTION: Replace the Pressure Control Solenoid with the ***updated*** PCS, available from OEM under part number 10478146. Before installing the new PCS, turn the adjusting screw on the end of the solenoid in ***exactly 1/8 turn,*** as shown in Figure 24.
Inspect and replace as necessary, the boost valve and sleeve assembly located in the valve body, in the location shown in Figure 25. This valve train is available from Sonnax®, under part number 84754-30K, and is not yet available from OEM except in a complete valve body assembly.

SERVICE INFORMATION:

Pressure Control Solenoid (New Design From OEM) 10478146
Boost Valve and Sleeve Kit (Sonnax® Part No.) 84754-30K

TURN SCREW IN *"EXACTLY"* 1/8 TURN, *NO MORE*

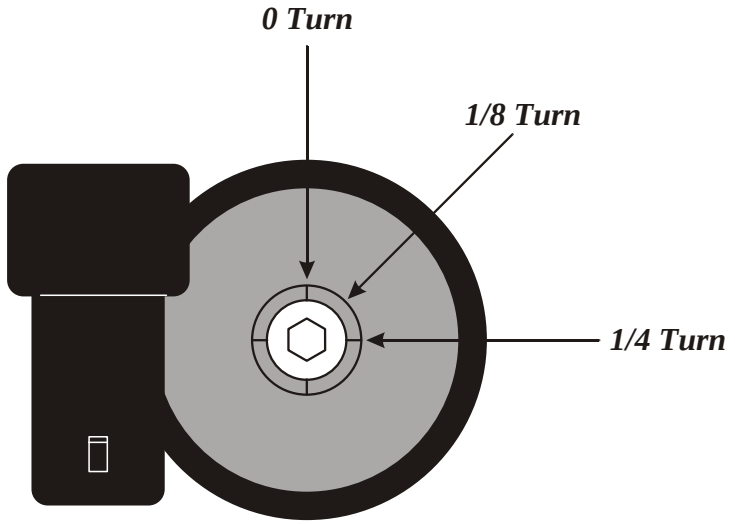
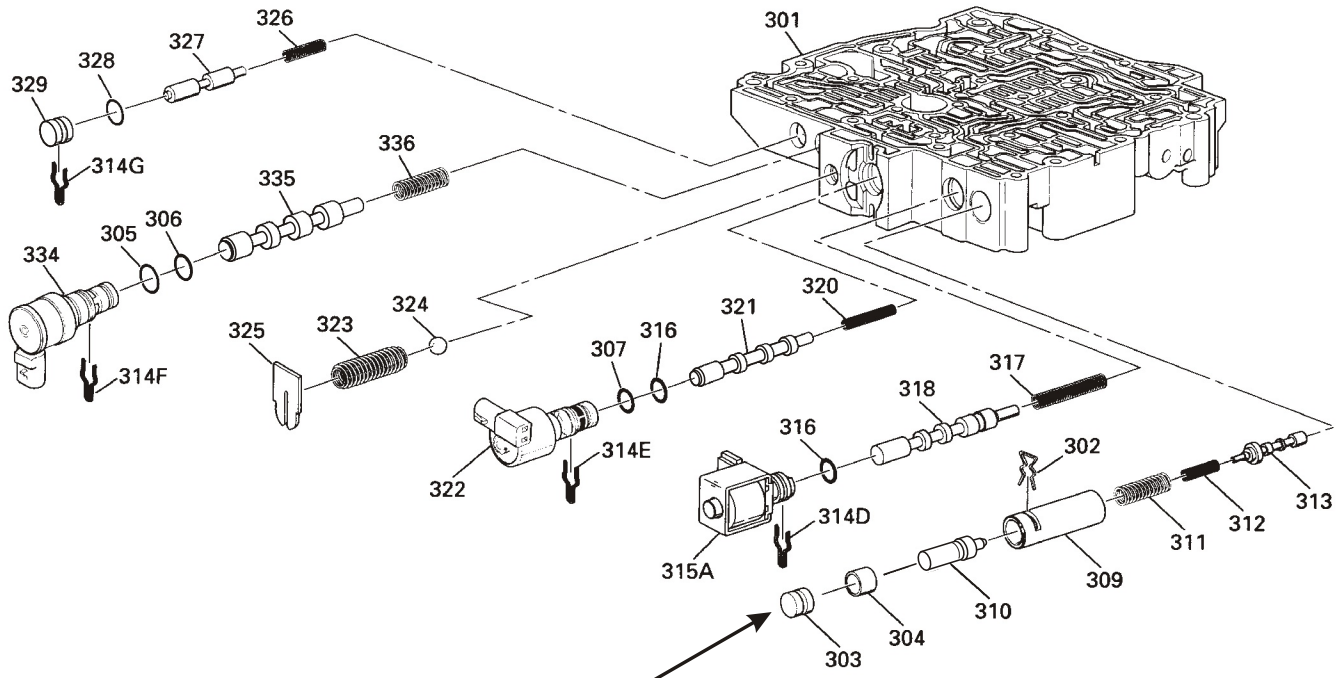
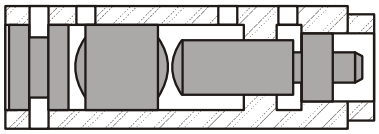
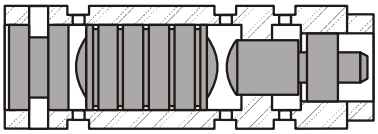


Figure 24





OEM Boost Valve And Sleeve Assembly



Sonnax® Boost Valve And Sleeve Assembly

301 CONTROL VALVE BODY
302 LINE BOOST VALVE AND BUSHING RETAINER
303 LINE BOOST VALVE BORE PLUG
304 LINE BOOST VALVE
305 TCC PWM SOLENOID "O" RING SEAL
306 TCC PWM SOLENOID "O" RING SEAL
307 PRESSURE CONTROL SOLENOID "O" RING SEAL
309 REVERSE BOOST VALVE BUSHING
310 REVERSE BOOST VALVE
311 PRESSURE REGULATOR VALVE OUTER SPRING
312 PRESSURE REGULATOR VALVE INNER SPRING
313 PRESSURE REGULATOR VALVE
314D 1-2, 3-4 SHIFT SOLENOID RETAINER
314E PRESSURE CONTROL SOLENOID RETAINER
314F TCC PWM SOLENOID RETAINER
314G TCC REGULATOR APPLY VALVE BORE PLUG RETAINER
315A 1-2, 3-4 SHIFT SOLENOID ASSEMBLY
316A 1-2, 3-4 SHIFT SOLENOID "O" RING SEAL
317 1-2 SHIFT VALVE SPRING
318 1-2 SHIFT VALVE
320 TORQUE SIGNAL REGULATOR VALVE SPRING
321 TORQUE SIGNAL REGULATOR VALVE
322 PRESSURE CONTROL SOLENOID ASSEMBLY
323 LINE PRESSURE RELIEF VALVE SPRING
324 LINE PRESSURE RELIEF VALVE
325 LINE PRESSURE RELIEF VALVE SPRING RETAINER
326 TCC REGULATOR APPLY VALVE SPRING
327 TCC REGULATOR APPLY VALVE
328 TCC REGULATOR APPLY VALVE BORE PLUG "O" RING SEAL
329 TCC REGULATOR APPLY VALVE BORE PLUG
334 TCC PWM SOLENOID ASSEMBLY
335 TCC CONTROL VALVE
336 TCC CONTROL VALVE SPRING

Figure 25

THM 4T65-E

NO 1ST OR 4TH GEAR, 2ND AND 3RD GEAR ONLY

COMPLAINT: A complaint of second gear starts with a shift into third and no fourth. Gear ratio codes may or may not be present. Computer command signals to the solenoids for first, second, third and fourth have been verified. Solenoids have been replaced, and in some cases even the valve body.

CAUSE: One cause may be a stuck Actuator Feed Limit Valve, located in the channel plate, as seen in Figure 26. With this valve stuck, solenoid feed oil to shift solenoid 1-2/3-4 is either blocked or has insufficient flow rendering the solenoid inoperable as if the solenoid failed in the stuck off position mechanically. Shift solenoid 2-3 is not fed with Actuator Feed oil allowing it to continue to function as designed and thereby causing only second and third gears to be available, irregardless of the proper shift commands being provided by the computer. Also, inspect the orifice cup plug (412), as shown in Figure 26, for any debris that may be clogging the orifice.

CORRECTION: Free the Actuator Feed Limit valve.

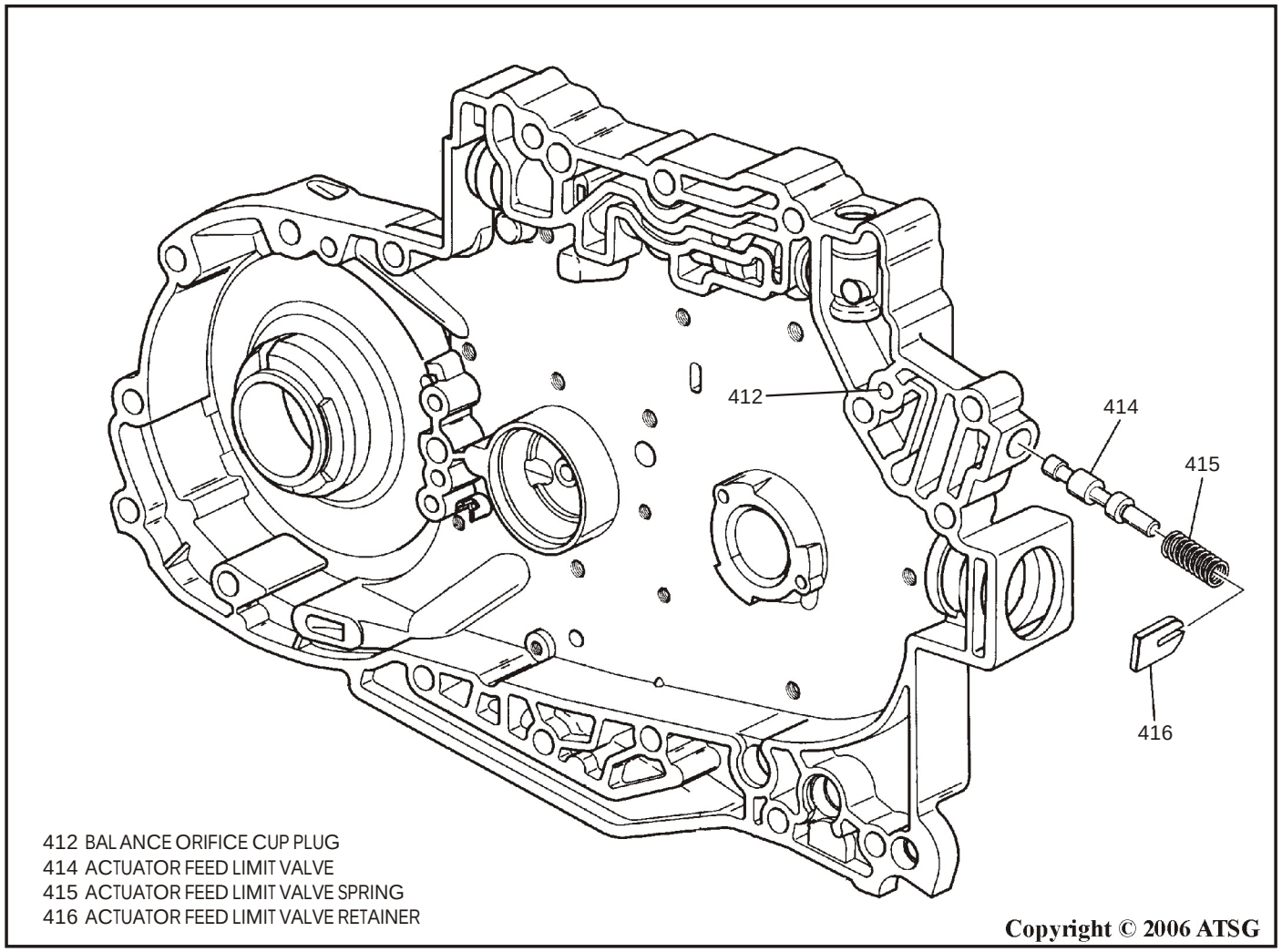


Figure 26

THM 4T65-E

RATTLING NOISE WITH ENGINE RUNNING

COMPLAINT: Some vehicles equipped with the THM 4T65-E transaxle may exhibit a rattling noise coming from the area of the side cover, and may occur in any gear.

CAUSE: The cause may be, the locating dowels (rivets) being loose in the input speed sensor reluctor wheel. Refer to Figure 27.

CORRECTION: Replace the input speed sensor reluctor wheel with updated OEM part number 24212217.

SERVICE INFORMATION:

Input Speed Sensor Reluctor Wheel 24212217

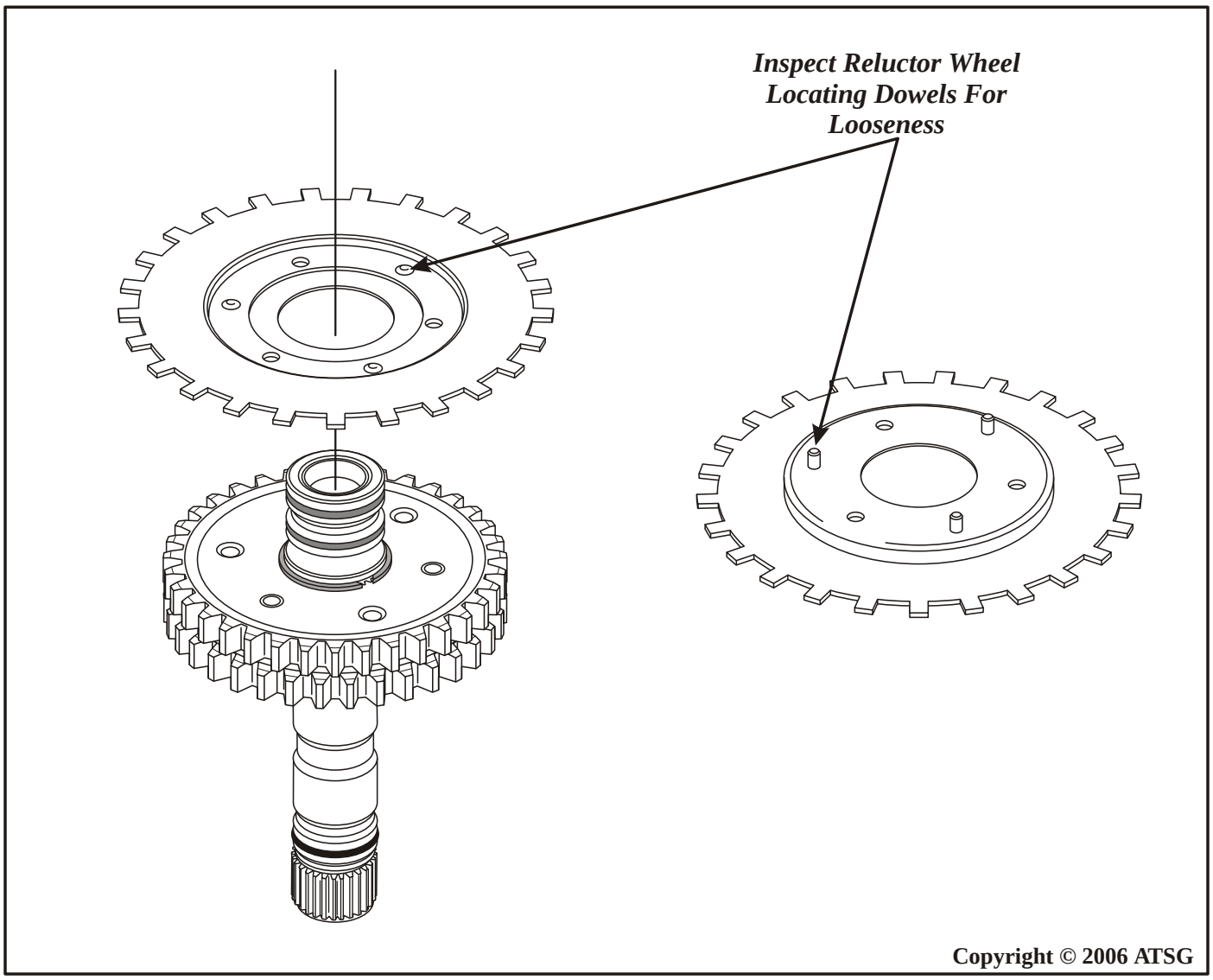


Figure 27

THM 4T65-E

ERRATIC OR NO ISS SIGNAL WITH DTC P0716

COMPLAINT: The vehicle displays an erratic Input Shaft Speed sensor signal or no signal at all, along with a DTC P0716 stored in memory.. In some cases gear ratio error codes may also accompany this complaint.

CAUSE: One cause may be, that an incorrect Input Shaft Speed Sensor was installed into the vehicle. All General Motors applications utilize an AC Pulse Generator as shown in Figure 28, while all Volvo applications use a two wire Hall Effect Sensor, as shown in Figure 29. Both will install into the channel plate and plug into the wire harness without incident. ***These speed sensors will not interchange.***

Typically the AC Pulse Generator type can be quickly identified by the magnetic pole protruding off the tip of the sensor while the Hall Effect does not. Another means of identification is, the Hall Effect Sensor ***will not*** have any resistance values, while the AC Pulse Generator has a resistance of 893 to 1127 ohms.

The most common error, is that the AC Pulse Generator is installed in a Volvo, instead of the Hall Effect Sensor, as the AC Pulse Generator is less expensive than the Hall Effect.

CORRECTION: Install the correct style Input Shaft Speed Sensor.

SERVICE INFORMATION:

Volvo ISS Hall Effect Sensor.....1275599
GM ISS AC Pulse Generator.....10456509

ALL G.M. VEHICLES

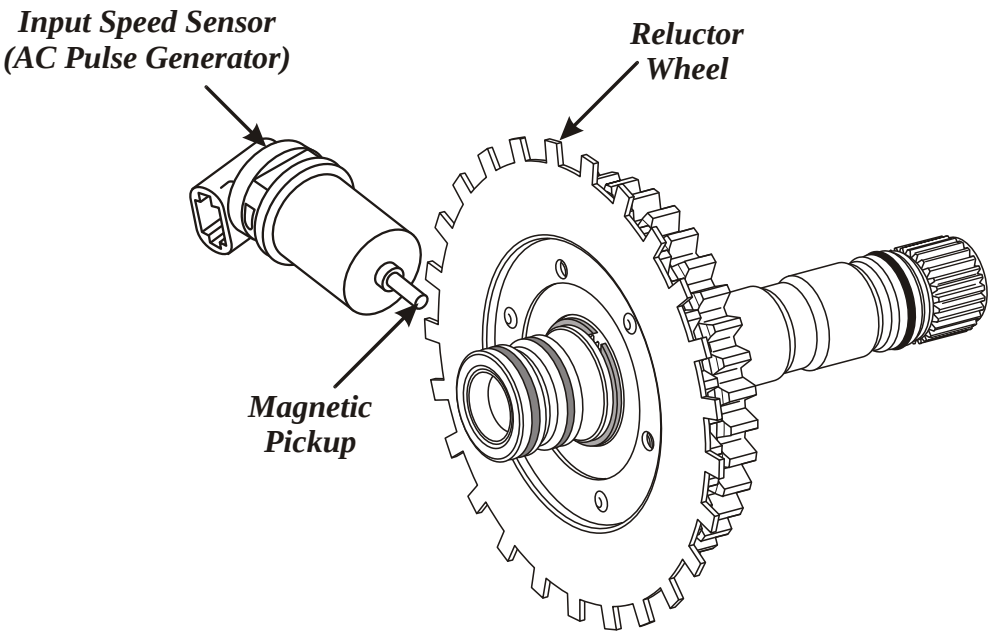


Figure 28

ALL VOLVO VEHICLES

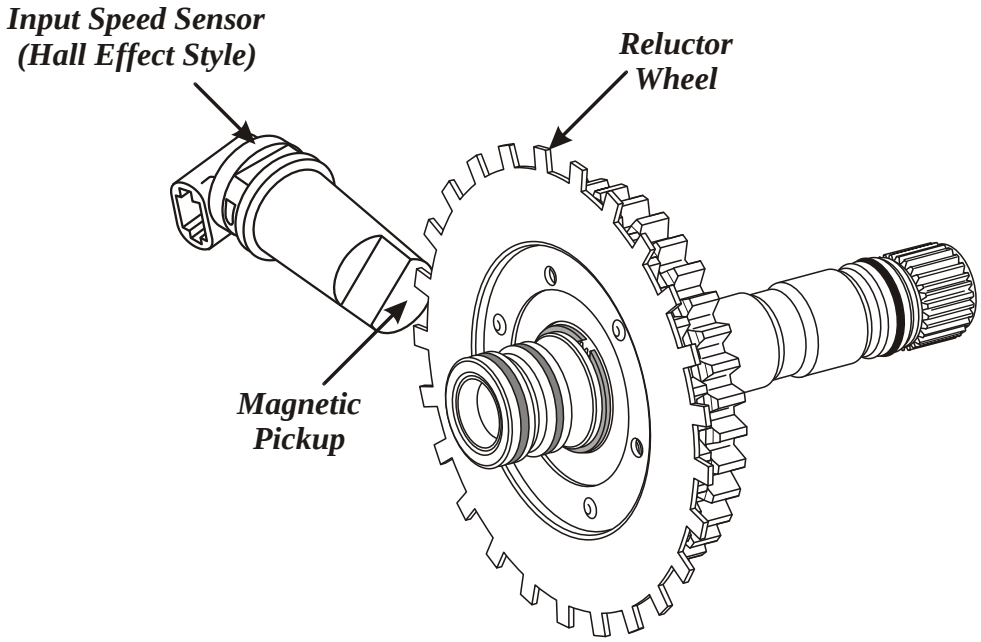


Figure 29

THM 4T65E

INTERNAL MODE SWITCH ADDED IN SOME MODELS

CHANGE: Beginning at the start of production for 1999, some models of the THM 4T65E were produced with an "Internal Mode Switch" (IMS). The transaxle Internal Mode Switch (IMS) is a sliding contact switch attached to the selector detent inside the transmission side cover, as shown in Figure 30. The four inputs to the PCM from the IMS indicate which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR and IAC valve operation, as well as for starting functions when the selector lever is in P or N and proper ground is made. The state of each input is available for display on the scan tool. The four input parameters represented are Mode P, Mode A, Mode B and Mode C (Refer to Figure 31).

REASON: Mounted internally for increased protection from the elements and engine compartment heat, for increased durability and reliability. This also eliminates the need for adjustments at the vehicle assembly plants.

PARTS AFFECTED:

(1) MODE SWITCH - Now mounted internally instead of externally on the transaxle case, and applies to only ***some*** models (See Figure 30).

(2) INTERNAL WIRE HARNESS - Five wires added to the internal harness to accommodate the new mode switch that now run through the transaxle case connector (See Figure 31).

(3) MANUAL VALVE LINK - Was made shorter to accommodate the added internal mode switch, as shown in Figure 31. We have also included other model manual valve links for comparison.

(4) MANUAL VALVE - Was made longer to accommodate the added internal mode switch, as shown in Figure 31.

DIAGNOSIS PROCEDURES:

(1) ***The new Internal Mode Switch fault can generate the following Diagnostic Trouble Codes:***
P1819 - Internal Mode Switch, No Start/Wrong Range
P1820 - Internal Mode Switch, Circuit "A" Low
P1822 - Internal Mode Switch, Circuit "B" High
P1825 - Internal Mode Switch, Invalid Range
P1826 - Internal Mode Switch, Circuit "C" High

Note: None of the above DTC's will illuminate the Malfunction Indicator Lamp (MIL).

(2) Refer to Figure 31 for Internal Mode Switch (IMS) connector terminal identification, wire colors, circuit functions, and manual valve link identification.

(3) Refer to Figure 32 for a complete wiring schematic from the transaxle through the transaxle case connector and on to the Powertrain Control Module (PCM). This includes wire colors both inside and outside and terminal identification of transaxle components.

(4) Refer to Figure 33 for identification of the transaxle case connector terminals that were added to accommodate the new IMS, and the wire colors and functions. We have also included a resistance chart for the internal transaxle components.

Continued on next Page.

DIAGNOSIS PROCEDURES (Cont'd)

(5) Refer to Figure 34 for identification of the PCM connector terminals, both Blue and the Clear connectors for the transaxle related components.

(6) Refer to Figure 35 for an Internal Mode Switch Logic chart that will provide you with the proper readings for all four input parameters for the IMS. These can be viewed from the appropriate scan tool.

(7) Figure 36 provides you with the information to bench check the Internal Mode Switch for the proper continuity at the Internal Mode Switch connector, and Figure 37 provides you the same information to check the switch at the transaxle case connector terminals.

INSTALLATION PROCEDURES:

The new Internal Mode Switch also allows you to make an assembly error on the installation. Refer to Figure 38 for the most common "Incorrect" assembly, and refer to Figure 39 for the "Correct" assembly of the Internal Mode Switch. Refer to the description of the complaint below, when and if, you do install it wrong.

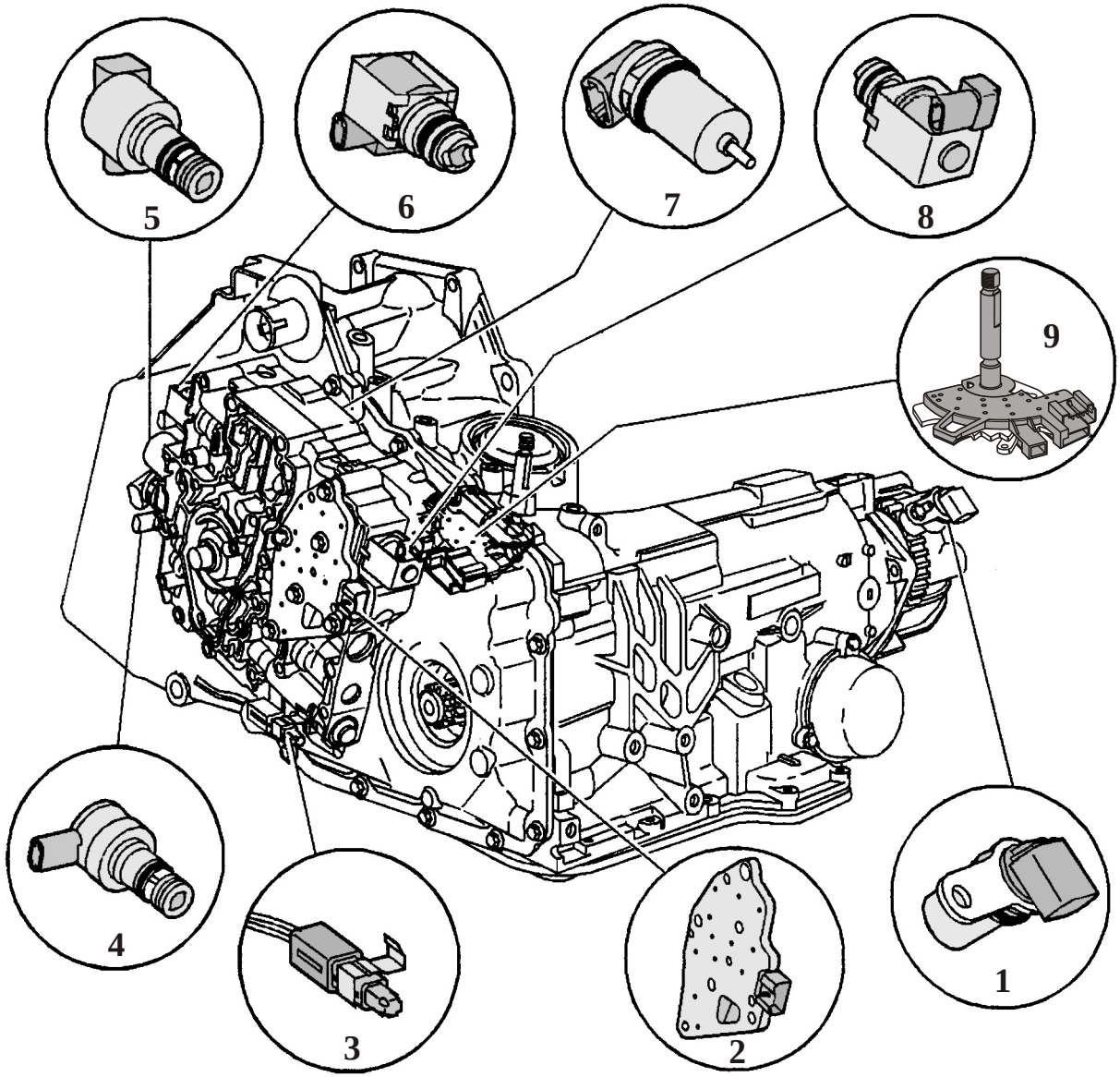
COMPLAINT: After overhaul and installation of the transmission back into the vehicle, the vehicle would not start in park or neutral. The transmission also would start in second gear and would make a 2-3 shift only. ***No codes were stored.***
When the scan tool was connected and the IMS parameters were viewed, the range indication readings were erratic. The normal parameter readings for the IMS can be seen in the scan tool screen capture in Figure 35 along with the IMS range chart.
Circuit identification for the IMS at the transmission case connector can be seen in Figure 33. The IMS circuits at the PCM can be seen in Figure 34.

CAUSE: When the detent spring was installed during the overhaul, it ***was not*** indexed in its proper location at the IMS which can be seen in Figure 38. When this is done the IMS can move across the detent lever ¼" in either direction. Therefore movement of the shift lever is not synchronized with the IMS causing the above complaints.

CORRECTION: Install the detent spring at the IMS as shown in Figure 39. ***It is the detent spring roller that properly indexes the IMS.*** When the IMS and detent spring are indexed correctly, there will be no movement of the IMS across the detent lever.

NOTE: This type of IMS can also be found on the 4T80E and 5L40E.

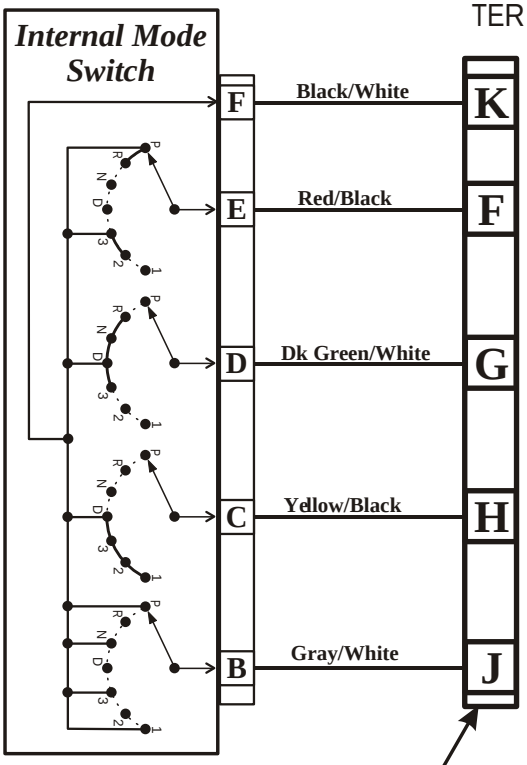
THM 4T65E
INTERNAL MODE SWITCH LOCATION



1. OUTPUT SPEED SENSOR
2. TRANSMISSION FLUID PRESSURE SWITCH ASSEMBLY
3. TRANSMISSION FLUID TEMPERATURE SENSOR
4. TCC PWM SOLENOID
5. PRESSURE CONTROL SOLENOID
6. 1-2/3-4 SHIFT SOLENOID
7. INPUT SPEED SENSOR
8. 2-3 SHIFT SOLENOID
9. INTERNAL MODE SWITCH

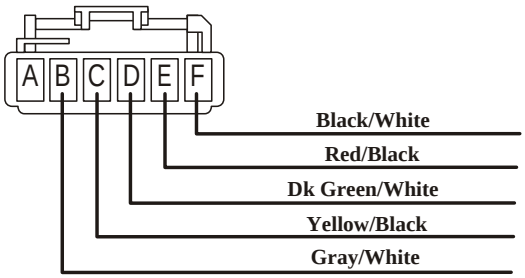
Figure 30

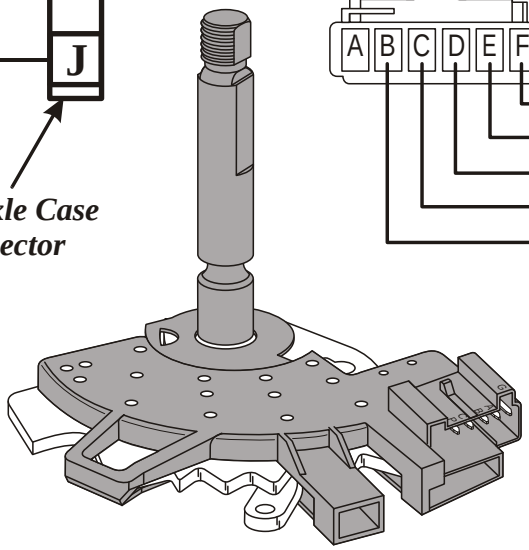
INTERNAL MODE SWITCH CONNECTOR
TERMINAL IDENTIFICATION

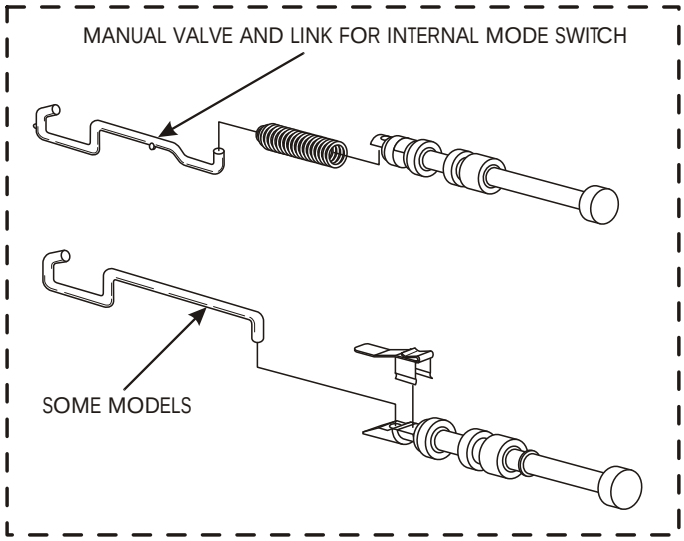


INTERNAL MODE SWITCH (IMS) CONNECTOR			
PIN	**WIRE COLOR**	**CIRCUIT NO.**	**FUNCTION**
A	———	———	*NOT USED*
B	*GRAY/WHT*	*776*	*IMS MODE P*
C	*YEL/BLK*	*773*	*IMS MODE C*
D	*DK GRN/WHT*	*772*	*IMS MODE B*
E	*RED/BLK*	*771*	*IMS MODE A*
F	*BLK/WHT*	*1050*	*GROUND*

View Looking At Wire Side Of IMS Connector







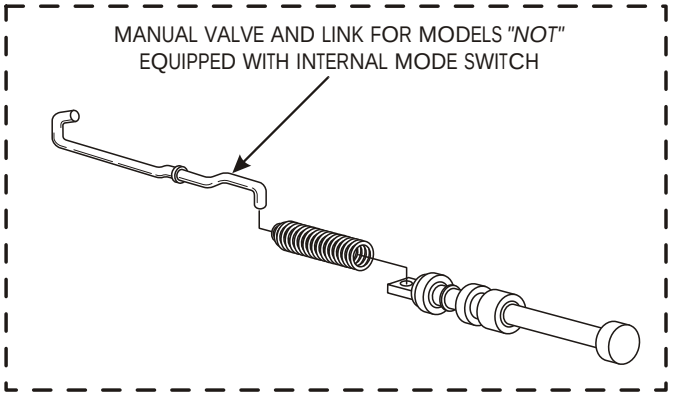


Figure 31

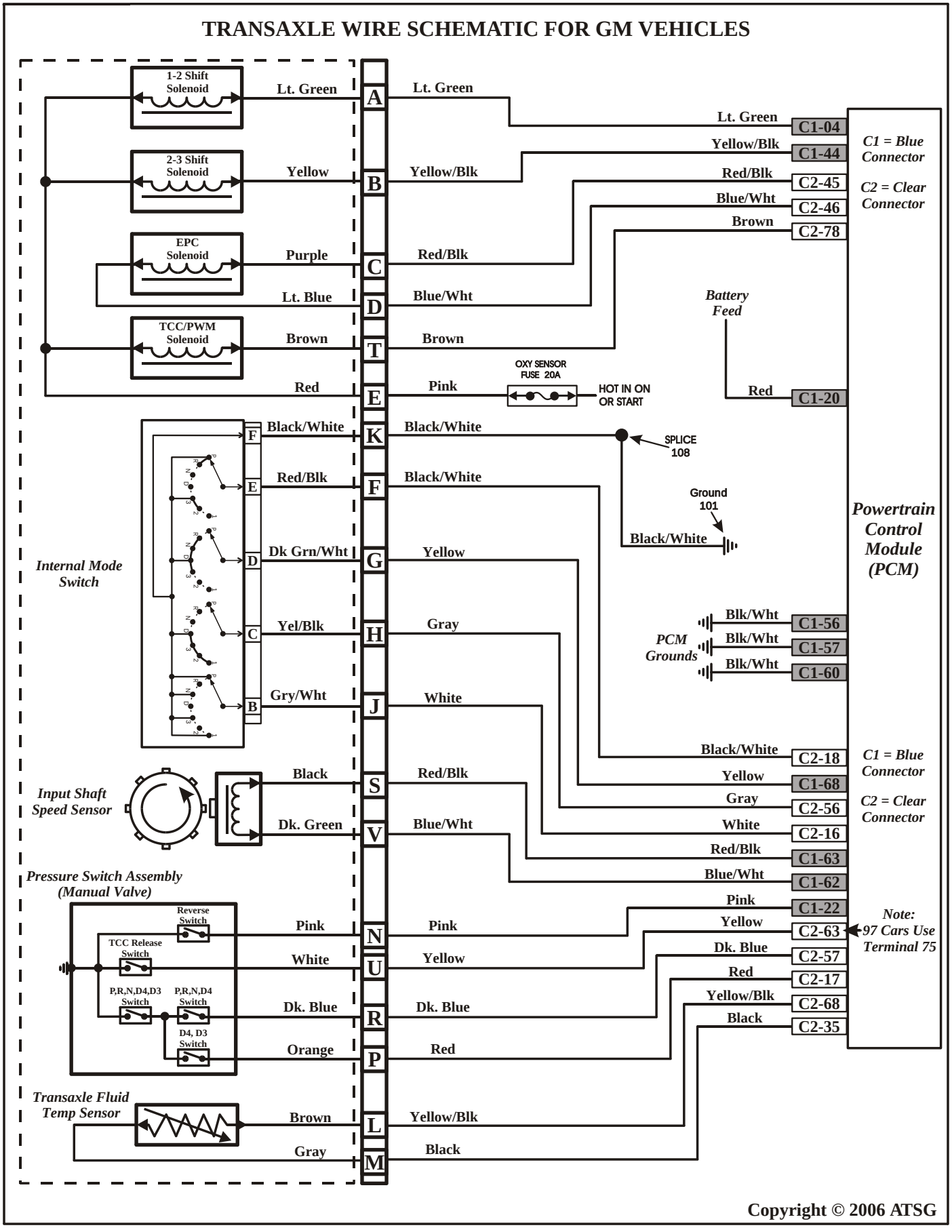
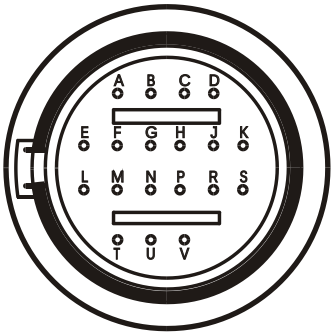

TRANSAXLE WIRE SCHEMATIC FOR GM VEHICLES
1-2 Shift Solenoid
2-3 Shift Solenoid
EPC Solenoid
TCC/PWM Solenoid
Internal Mode Switch
Input Shaft Speed Sensor
Pressure Switch Assembly (Manual Valve)
Reverse Switch
TCC Release Switch
P,R,N,D4,D3 Switch
P,R,N,D4 Switch
D4, D3 Switch
Transaxle Fluid Temp Sensor
Lt. Green
Yellow
Purple
Lt. Blue
Brown
Red
Black/White
Red/Blk
Dk Grn/Wht
Yel/Blk
Gry/Wht
Black
Dk. Green
Pink
White
Dk. Blue
Orange
Brown
Gray
A
B
C
D
T
E
F
K
F
G
H
J
S
V
N
U
R
P
L
M
OXY SENSOR FUSE 20A
HOT IN ON OR START
Battery Feed
SPLICE 108
Ground 101
PCM Grounds
Blk/Wht
C1-56
C1-57
C1-60
C1-04
C1-44
C2-45
C2-46
C2-78
C1-20
C2-18
C1-68
C2-56
C2-16
C1-63
C1-62
C1-22
C2-63
C2-57
C2-17
C2-68
C2-35
C1 = Blue Connector
C2 = Clear Connector
Powertrain Control Module (PCM)
Note: 97 Cars Use Terminal 75
Copyright © 2006 ATSG

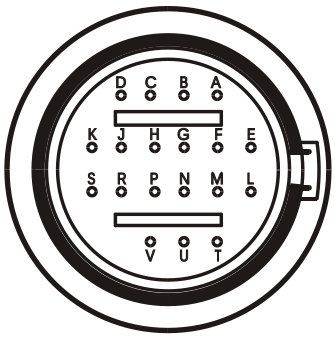
Figure 32

GM TRANSAXLE CASE CONNECTOR PIN IDENTIFICATION AND RESISTANCE CHART



View Looking Into Transaxle Case Connector

Ohms Resistance Chart			
Cavities	**Component**	**Resistance @ 68°F**	**Resistance @ 190°F**
A-E	**1-2 Shift Solenoid (A)**	**19-24W**	**24-31W**
B-E	**2-3 Shift Solenoid (B)**	**19-24W**	**24-31W**
T-E	**TCC/PWM Solenoid**	**10-12W**	**13-15W**
C-D	**EPC Solenoid**	**3-5W**	**5-6W**
S-V	**Input Speed Sensor**	**893-1127W**	**1132-1428W**
M-L	**TFT Sensor**	**3164-3867W**	**225-285W**
	Output Speed Sensor	**981-1864W**	



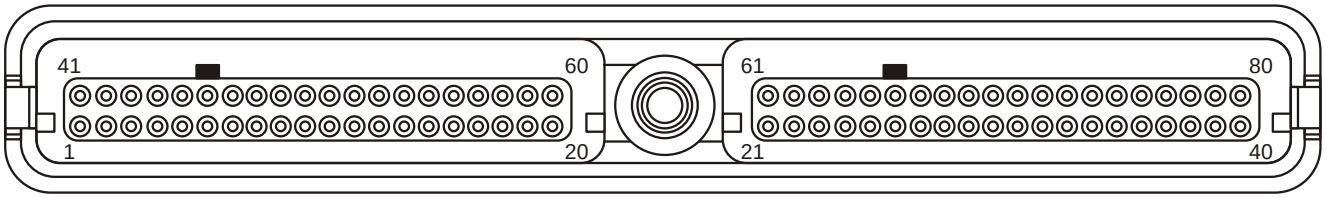
View Looking Into Vehicle Harness Connector

GM CASE CONNECTOR PIN FUNCTION

Pin	External Wire Color	Function
A	**Light Green**	**Ground signal from PCM for the 1-2 Shift Solenoid (A)**
B	**Yellow/Black**	**Ground signal from PCM for the 2-3 Shift Solenoid (B)**
C	**Red/Black**	**Electronic Pressure Control Solenoid, HIGH Control**
D	**Blue/White**	**Electronic Pressure Control Solenoid, LOW Control**
E	**Pink**	**Transaxle Solenoid 12V Power In**
F	**Black/White**	**Internal Mode Switch Range Signal "A"**
G	**Yellow**	**Internal Mode Switch Range Signal "B"**
H	**Gray**	**Internal Mode Switch Range Signal "C"**
J	**White**	**Internal Mode Switch Range Signal "P"**
K	**Black/White**	**Internal Mode Switch ground**
L	**Yellow/Black**	**Transaxle Fluid Temperature (TFT) Sensor HIGH**
M	**Black**	**Transaxle Fluid Temperature (TFT) Sensor LOW**
N	**Pink**	**Pressure Switch Assembly, Range Signal "A"**
P	**Red**	**Pressure Switch Assembly, Range Signal "C"**
R	**Dark Blue**	**Pressure Switch Assembly, Range Signal "B"**
S	**Red/Black**	**Input Speed Sensor (ISS) signal HIGH**
T	**Brown**	**Ground signal from PCM for the TCC/PWM Converter Clutch Solenoid**
U	**Yellow**	**TCC Release Switch signal to the PCM**
V	**Blue/White**	**Input Speed Sensor (ISS) signal LOW**

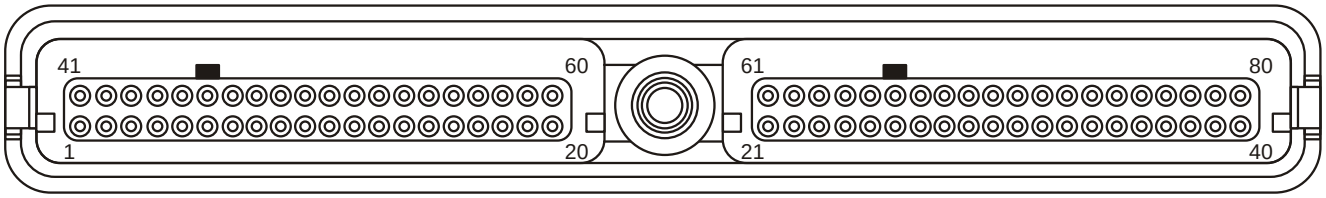
Figure 33

C1 "BLUE" PCM CONNECTOR



Pin No.	Wire Color	Circuit	Description
4	*Lt Green*	*1222*	*Shift Solenoid "A" Ground Signal*
20	*Red*	*1642*	*Battery Feed*
22	*Pink*	*1224*	*Transaxle Fluid Pressure Switch "A" Input*
44	*Yellow/Black*	*1223*	*Shift Solenoid "B" Ground Signal*
56	*Black/White*	*451*	*PCM Ground*
57	*Black/White*	*451*	*PCM Ground*
60	*Black/White*	*451*	*PCM Ground*
62	*Dk Blue/White*	*1231*	*Input Shaft Speed Sensor, Low*
63	*Red/Black*	*1230*	*Input Shaft Speed Sensor, High*
68	*Yellow*	*772*	*Internal Mode Switch Signal "B"*

C2 "CLEAR" PCM CONNECTOR



Pin No.	Wire Color	Circuit	Description
16	*White*	*776*	*Internal Mode Switch Signal "P"*
17	*Red*	*1225*	*Transaxle Fluid Pressure Switch "C" Input*
18	*Black/White*	*771*	*Internal Mode Switch Signal "A"*
35	*Black*	*808*	*Transaxle Fluid Temperature Sensor Ground*
45	*Red/Black*	*1228*	*Pressure Control Solenoid, High*
46	*Lt Blue/White*	*1229*	*Pressure Control Solenoid, Low*
56	*Gray*	*773*	*Internal Mode Switch Signal "C"*
57	*Dk Blue*	*1225*	*Transaxle Fluid Pressure Switch "B" Input*
63/75	*Yellow*	*657*	*TCC Release Switch (97 Cars use Terminal 75)*
68	*Yellow/Black*	*1227*	*Transaxle Fluid Temperature Sensor*
78	*Brown*	*418*	*TCC PWM Solenoid Control*

Figure 34

INTERNAL MODE SWITCH LOGIC				
GEAR SELECTOR POSITION	SCAN TOOL IMS RANGE			
	A	B	C	P
PARK	*LOW*	*HI*	*HI*	*LOW*
PARK/REVERSE	*LOW*	*LOW*	*HI*	*LOW*
REVERSE	*LOW*	*LOW*	*HI*	*HI*
REVERSE/NEUTRAL	*HI*	*LOW*	*HI*	*HI*
NEUTRAL	*HI*	*LOW*	*HI*	*LOW*
NEUTRAL/DRIVE 4	*HI*	*LOW*	*LOW*	*LOW*
DRIVE 4	*HI*	*LOW*	*LOW*	*HI*
DRIVE 4/DRIVE 3	*LOW*	*LOW*	*LOW*	*HI*
DRIVE 3	*LOW*	*LOW*	*LOW*	*LOW*
DRIVE 3/DRIVE 2	*LOW*	*HI*	*LOW*	*LOW*
DRIVE 2	*LOW*	*HI*	*LOW*	*HI*
DRIVE 2/DRIVE 1	*HI*	*HI*	*LOW*	*HI*
DRIVE 1	*HI*	*HI*	*LOW*	*LOW*
ILLEGAL RANGES	*HI*	*HI*	*HI*	*HI*
	LOW	*HI*	*HI*	*HI*
	HI	*HI*	*HI*	*LOW*

HI = 12 Volts
LOW = 0 Volts

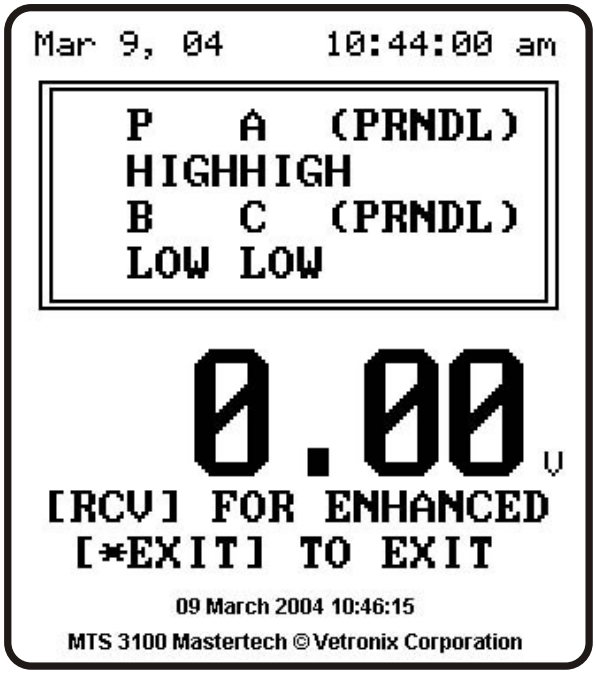


Figure 35

INTERNAL MODE SWITCH CONTINUITY CHECKS AT IMS CONNECTOR													
IMS TERMINALS	**MANUAL SHIFT DETENT LEVER POSITION**												
	P	**P/R**	**R**	**R/N**	**N**	**N/D4**	**D4**	**D4/D3**	**D3**	**D3/D2**	**D2**	**D2/D1**	**D1**
F to B	*C*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*
F to C	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*
F to D	*O*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*O*	*O*	*O*	*O*
F to E	*C*	*C*	*C*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*
E to B	*C*	*C*	*O*	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*O*	*O*	*O*
E to C	*O*	*O*	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*
E to D	*O*	*C*	*C*	*O*	*O*	*O*	*O*	*C*	*C*	*O*	*O*	*O*	*O*
D to B	*O*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*	*O*	*O*	*O*	*O*
D to C	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*	*O*	*O*
C to B	*O*	*O*	*O*	*O*	*O*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*

C = CLOSED CIRCUIT
O = OPEN CIRCUIT

SPECIAL NOTE:

Terminals B, C, D, E, and F must indicate an "OPEN" circuit when checked against the Internal Mode Switch shaft, through all ranges.

Figure 36

INTERNAL MODE SWITCH CONTINUITY CHECKS AT CASE CONNECTOR													
CASE CONNECTOR TERMINALS	**MANUAL SHIFT DETENT LEVER POSITION**												
	P	**P/R**	**R**	**R/N**	**N**	**N/D4**	**D4**	**D4/D3**	**D3**	**D3/D2**	**D2**	**D2/D1**	**D1**
K to J	*C*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*
K to H	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*
K to G	*O*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*O*	*O*	*O*	*O*
K to F	*C*	*C*	*C*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*
F to J	*C*	*C*	*O*	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*O*	*O*	*O*
F to H	*O*	*O*	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*
F to G	*O*	*C*	*C*	*O*	*O*	*O*	*O*	*C*	*C*	*O*	*O*	*O*	*O*
G to J	*O*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*	*O*	*O*	*O*	*O*
G to H	*O*	*O*	*O*	*O*	*O*	*C*	*C*	*C*	*C*	*O*	*O*	*O*	*O*
H to J	*O*	*O*	*O*	*O*	*O*	*C*	*O*	*O*	*C*	*C*	*O*	*O*	*C*

C = CLOSED CIRCUIT
O = OPEN CIRCUIT

SPECIAL NOTE:

Terminals B, C, D, E, and F must indicate an "OPEN" circuit when checked against the Internal Mode Switch shaft, through all ranges.

Figure 37

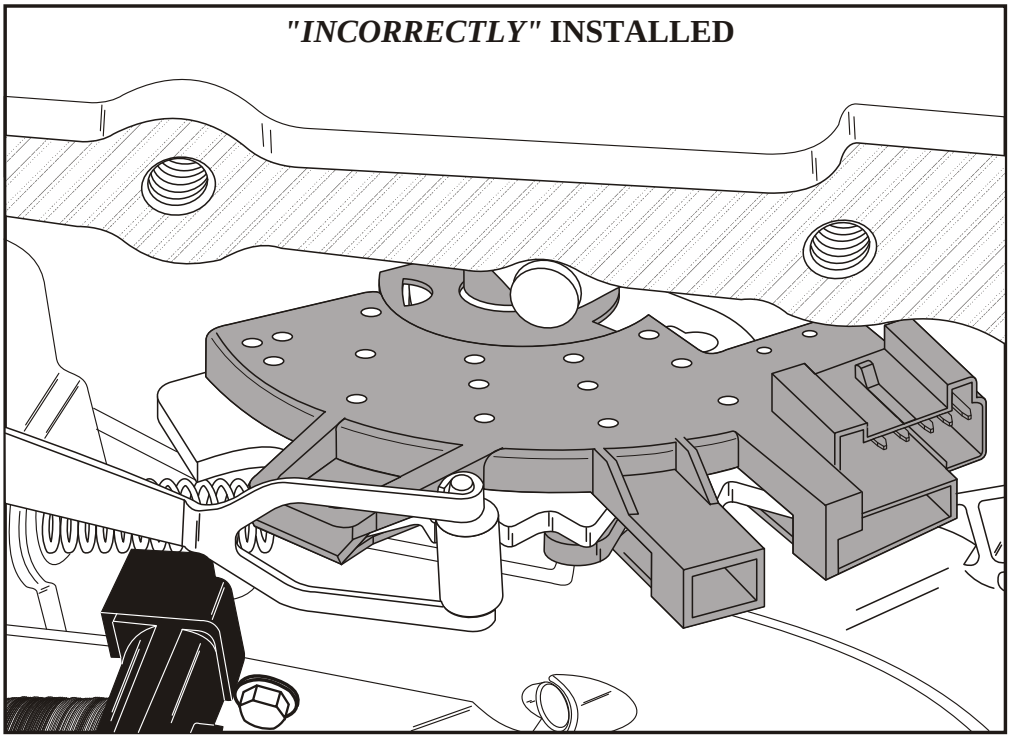


Figure 38

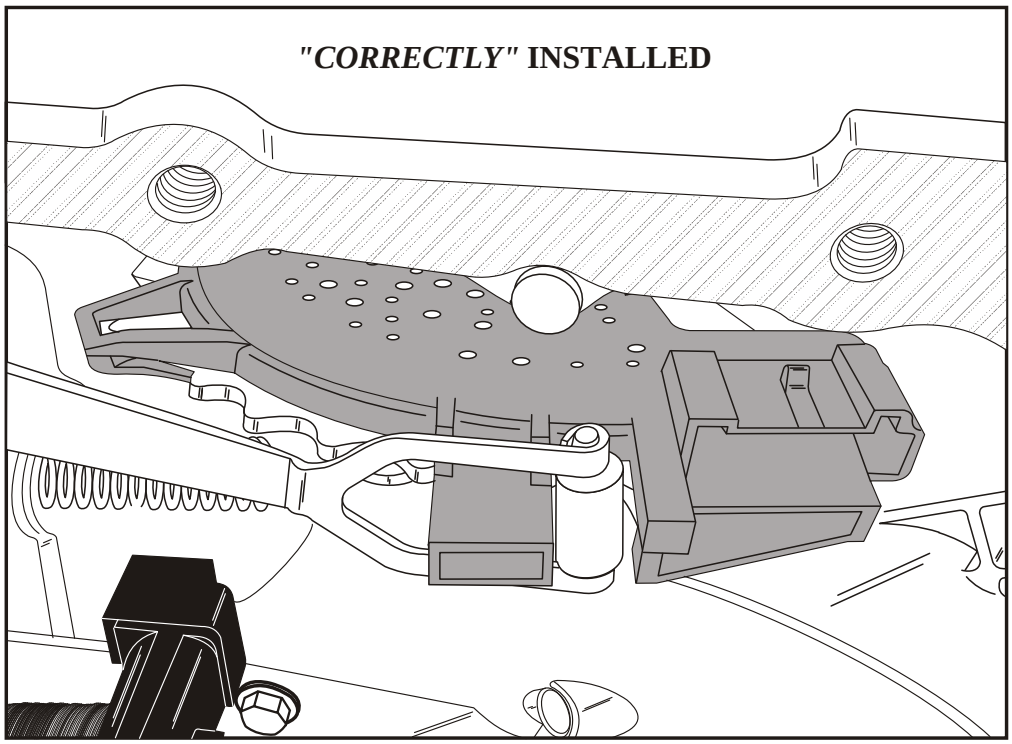


Figure 39

THM 4T65-E

VENTING TRANSMISSION FLUID
UPPER CHANNEL PLATE GASKET CHANGES

CHANGE: The upper channel plate gasket has now been changed twice which now creates three different design levels. All three design levels are illustrated in Figure 41.

REASON: The 1st design gasket would "blow out", as illustrated in Figure 40, which would allow full line pressure to be aimed right at the vent, and this was not a good thing. The top passage was eliminated in the 2nd design gasket, as shown in Figure 41. Unfortunately, this created more concerns of gaskets blown out due to excessive pressure. This required the 3rd design gasket which now has 2 slots in this area, as shown in Figure 41.

PARTS AFFECTED:

(1) UPPER CHANNEL PLATE GASKET - In the 3rd design gasket GM engineering has added 2 slots to improve fluid flow, as shown in Figure 41.

INERCHANGEABILITY:

This was a running change at the assembly plant, and the 3rd design gasket will replace all previous gaskets for all models (See Figure 41). The 3rd design gasket is now included in the aftermarket gasket sets.

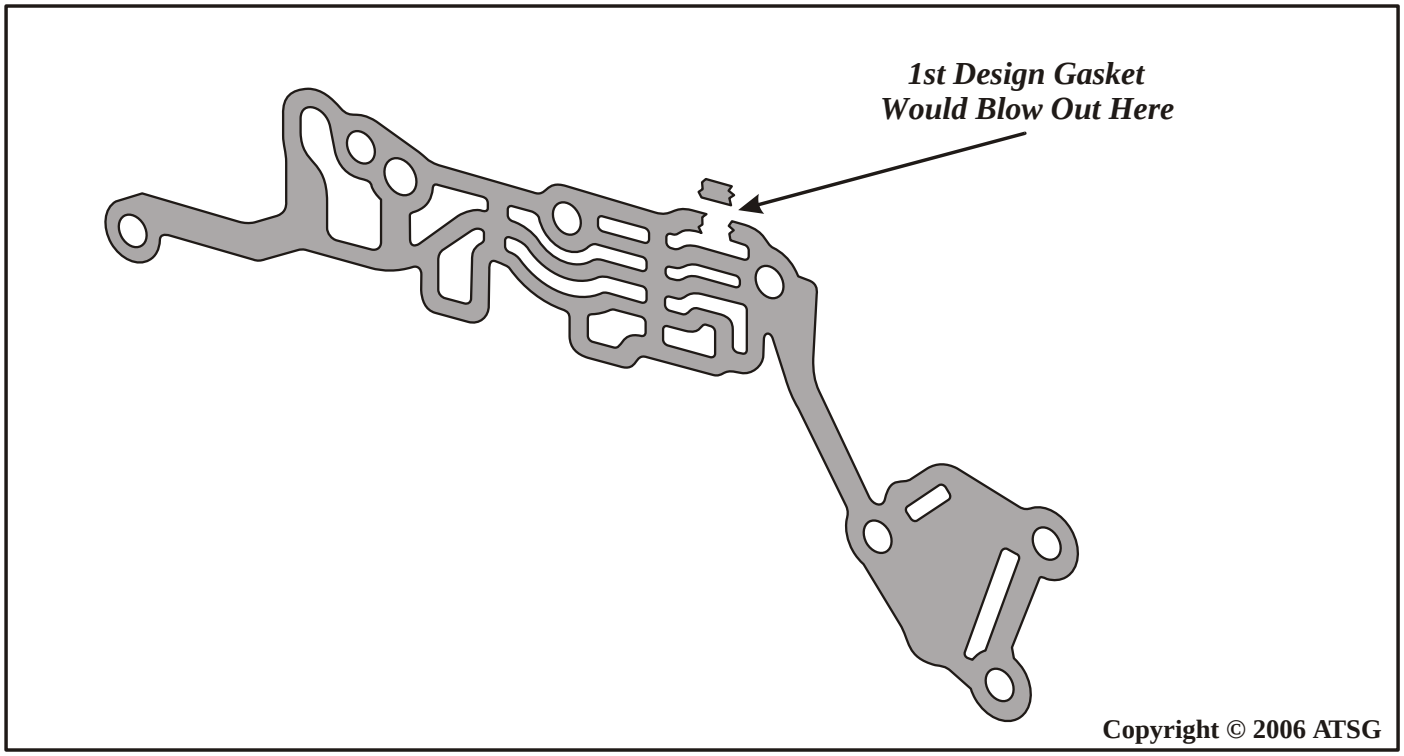


Figure 40

UPPER CHANNEL PLATE GASKET CHANGES

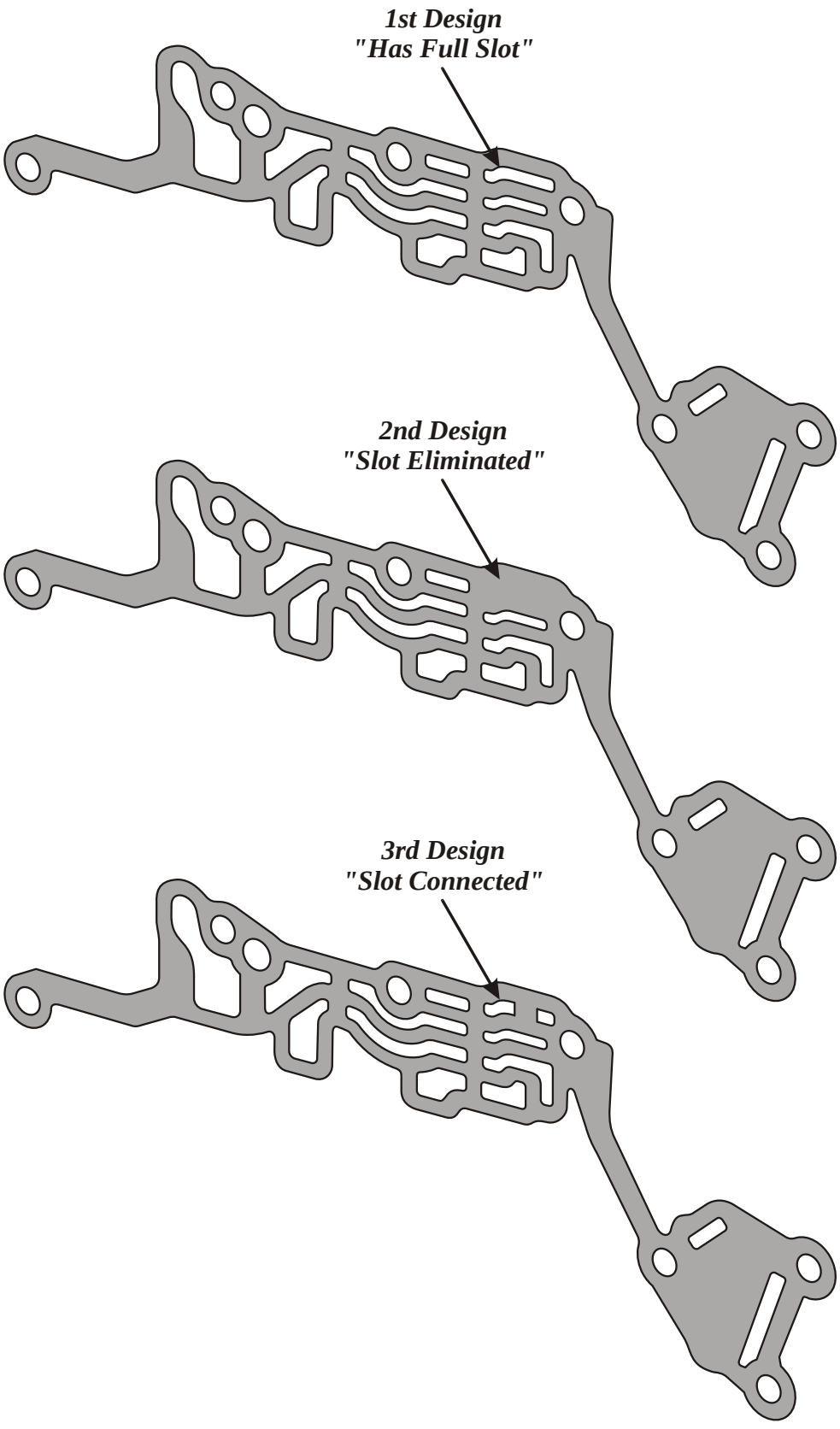


Figure 41

THM 4T65-E

NO 3-4 SHIFT

COMPLAINT: Any General Motors or import vehicle, equipped with the THM 4T65-E transaxle may come into the shop with a complaint of no 3-4 shift at any time.
The PCM (TCM for some imports) ***may*** or ***may not*** store any Diagnostic Trouble Codes, such as P0751 (Shift Solenoid "A") or P0730 (Undefined/Incorrect Gear Ratio). All electrical components check okay.

CAUSE: The cause may be, stripped splines on the 4th clutch hub and shaft where it splines into the input sun gear, as shown in Figure 42.

CORRECTION: Replace the 4th clutch hub and shaft assembly with a new one. Extra care should be exercised when inspecting this area on your normal overhaul, as this is a very common wear area on higher mileage units.

SERVICE INFORMATION:

4th Clutch Hub and Shaft 24205603

4TH CLUTCH HUB AND SHAFT

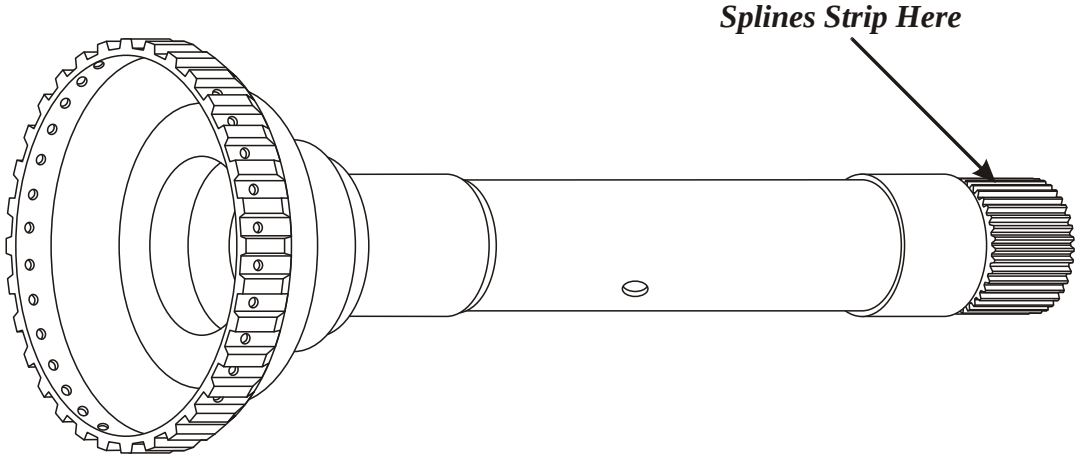


Figure 42

THM 4T65-E

NEW DESIGN "PAWL" CLUTCH TYPE FREEWHEEL FOR INPUT AND THIRD

CHANGE: Some 2003 model THM 4T65-E transaxles will come equipped with a newly designed Input and Third "Pawl" Clutch Assembly instead of the previous design Input and Third Sprag Clutch, as shown in Figures 43 and 44. This was implemented at start of production for the 2003 model year.

REASON: Ease of assembly and cost savings.

PARTS AFFECTED:

(1) INPUT "PAWL" CLUTCH - The new design outer race has 30 splines instead of the previous 32 on the Input Sprag and cannot be disassembled like the previous design Sprag Clutch, which obviously makes the assembly process easier. Refer to Figures 43 and 44 for illustrations of both designs.

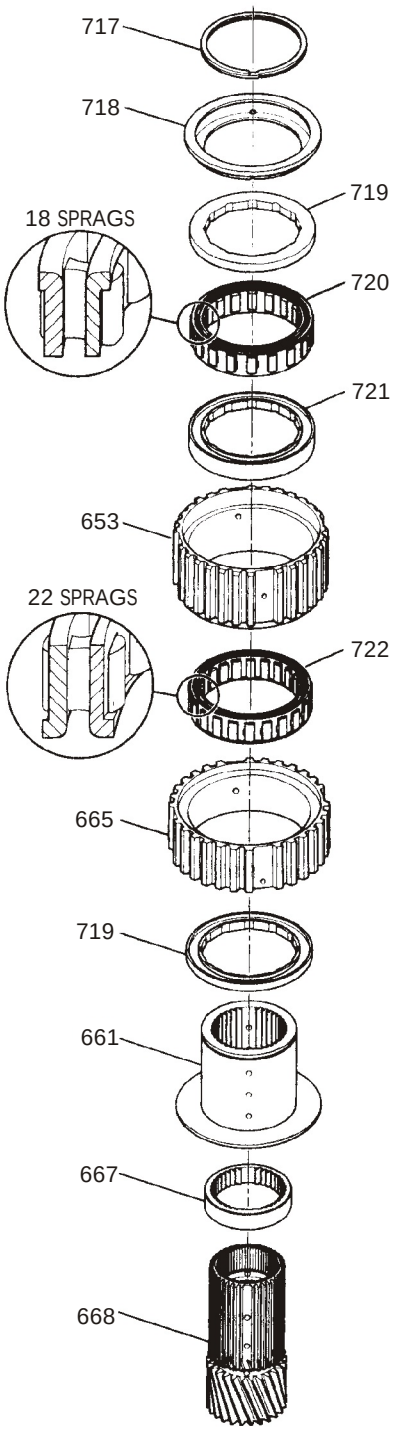
(2) INPUT CLUTCH FIBER PLATE - The new design fiber plate has 30 teeth instead of the previous design 32 teeth, to accommodate the new design "Pawl" Clutch Assembly. Refer to Figure 45 for illustrations of both designs.

(3) THIRD "PAWL" CLUTCH - The new design cannot be disassembled, like the previous design Sprag Clutch, which obviously makes the assembly process easier. Refer to Figures 43 and 44 for illustrations of both designs. The third clutch fiber plates remain the same as previous models.

INTERCHANGEABILITY:

The above listed parts will back service any model 4T65-E transaxle equipped with the previous "Dual Sprag" design, ***when all parts are used as a service package.***
Note: To maintain proper operating clearances within the transaxle, these parts must be used as a set. Do not mix these parts with any previous design assemblies.

SERVICE INFORMATION:	***Borg Warner***	***OEM***
Input Pawl Clutch Assembly	13013BW	24216816
Input Clutch Friction (Mates with Pawl Clutch)	29194AM	24216502
Third Pawl Clutch Assembly	13000BW	24216817



653 3RD CLUTCH SPRAG OUTER RACE
661 INPUT/3RD CLUTCH SPRAG INNER RACE
665 INPUT CLUTCH SPRAG OUTER RACE
667 INPUT SUN GEAR SPACER
668 INPUT SUN GEAR
717 SPIRAL LOCKING RING
718 3RD CLUTCH SPRAG RETAINER
719 SPRAG END BEARINGS (2)
720 3RD SPRAG ASSEMBLY
721 SPRAG CENTER BEARING
722 INPUT SPRAG ASSEMBLY

Figure 43

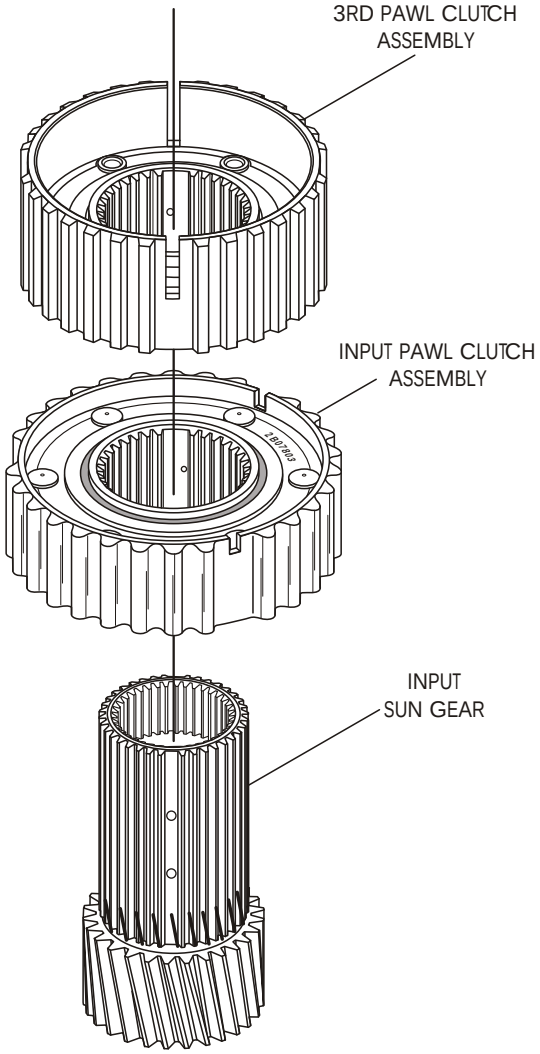


Figure 44

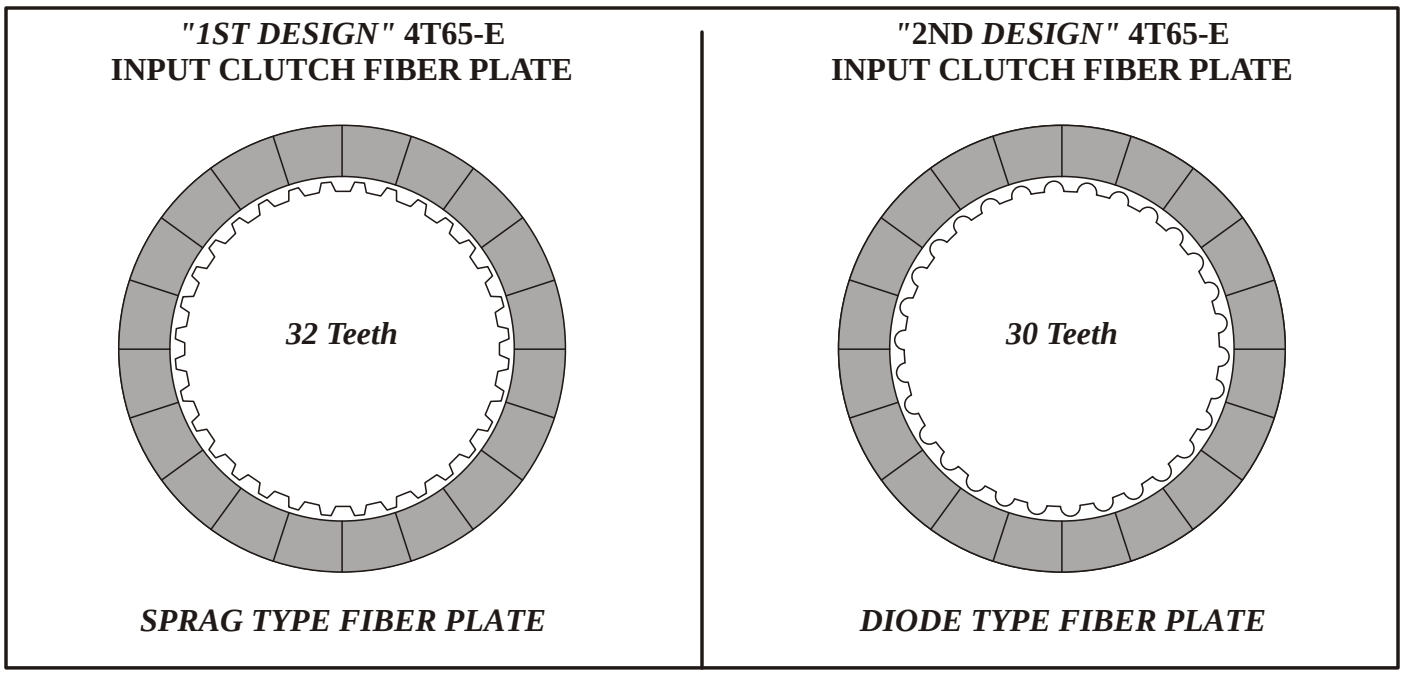


Figure 45

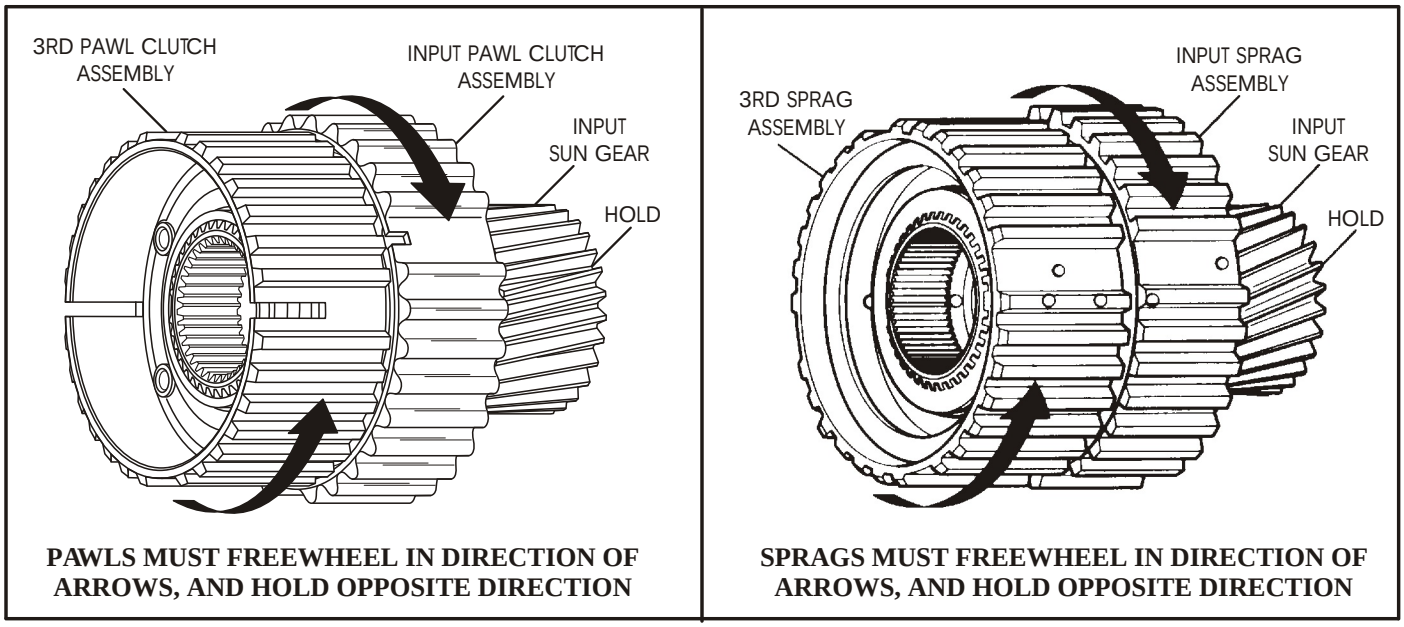


Figure 46

THM 4T65-E

SHIFT QUALITY CONCERNS OR EXCESSIVE CLUTCH CLEARANCE

COMPLAINT: After overhaul, the transaxle may exhibit long drawn-out upshifts at higher throttle openings or wide open throttle position. Data viewed on the scan tool display indicates that the 1-2 shift and/or the 2-3 shift have shift duration exceeding the accepted 0.65 seconds. This same result is indicated when viewing the Trans Adaptive Pressure (TAP-CELL) parameters. The PCM ***may*** or ***may not*** store code P1811.

CAUSE: The cause may be, excessive clutch clearance in the 2nd clutch and/or 3rd clutch packs which would require a higher volume of oil to fill the cavity and compress the wave plate before the clutch can be fully applied. It is common to find as much as .130" or more clearance, with no evidence of friction plate deterioration. There are no selective elements available from OEM so they do not provide a clutch clearance specification.

CORRECTION: As a general rule, clutch packs require .008"-.012" of clearance for each friction plate, unless otherwise specified in a factory service manual. Some clutch packs, referred to as "Single Sided" plates, will have friction material on one side of both the drive and driven plates. ***If this is the case, pick one set or the other, not the total of both combined.*** An example of this is the 3rd clutch in the 4T65-E transaxle. With less than .008" clearance per friction plate, you risk having the clutch plates drag when they are not applied, creating a scorched plate from lack of lube.

2ND CLUTCH ASSEMBLY:

The 2nd clutch assembly has 6 friction plates, 5 steel plates and 1 wave plate, as shown in the housing cut-away in Figure 47. Referring back to the "general rule", this means that our preferred 2nd clutch clearance should be .048"-.072". The OEM steel plates are .068" thick. If the 2nd clutch clearance is .116" or more, adding an extra steel plate on top of the wave plate may be all that is needed to correct this concern.

There are also thicker steel plates now available, from ALTO Products, that are .088" thick so that you can "fine tune" your 2nd clutch clearance. ALTO Products part number is 062733-228.

Special Note: Do not attempt to eliminate the "Waved" plate. If it is broken, warped or has become flat, replacement will be mandatory.

CORRECTION (Cont'd):

3RD CLUTCH ASSEMBLY:

The 3rd clutch assembly has 5 "Single Sided" driving plates (external spline), and 5 "Single Sided" driven plates (internal spline), and 1 wave plate, as shown in the housing cut-away in Figure 48. Referring back to the "general rule", this means that our preferred 3rd clutch clearance should be .040"-.060". The OEM driving plates are .076" in total thickness with the steel core measuring .048". The OEM driven plates are .082" in total thickness with the steel core measuring .050". If the 3rd clutch clearance is .088" or more, you could remove the friction material from one extra external spline driving plate and place it on top of the wave plate first, and then add the normal stack of drive and driven "Single Sided" plates.
Another possibility is substituting various model 4T60-E or 440-T4 3rd clutch plates until the preferred clutch clearance is obtained.
Special Note: Do not attempt to eliminate the "Waved" plate. If it is broken, warped or has become flat, replacement will be mandatory.

SPACER PLATE:

Further modification to the valve body spacer plate can also be made to allow the 2nd clutch and 3rd clutch cavities to fill quicker. Opening the 2nd and/or 3rd clutch feed orifices in the spacer plate .010" larger than original, as shown in Figure 49, will also allow a larger volume of oil the the clutch pack. The original orifice size is .070".
Special Note: Spacer plate orifice modification is not a recommended procedure as part of a normal overhaul. ***This should be considered as an option, only after all other possibilities have been eliminated. Never exceed .082" total orifice size.***

TYPICAL 2ND CLUTCH HOUSING

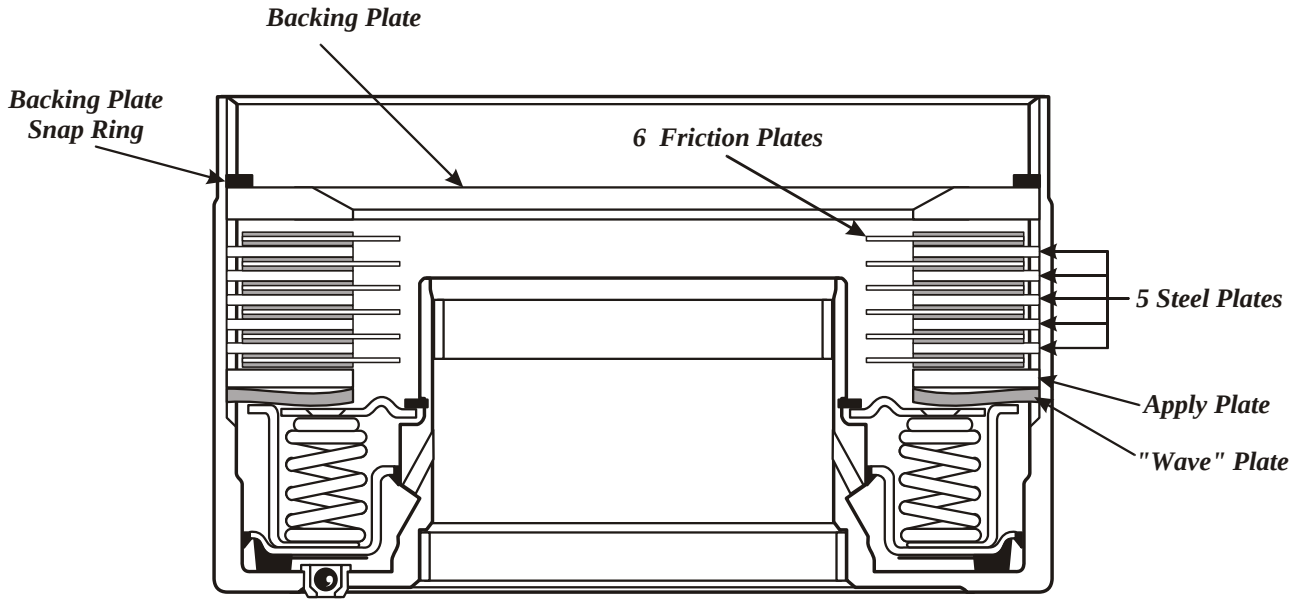


Figure 47

TYPICAL INPUT/3RD CLUTCH HOUSING

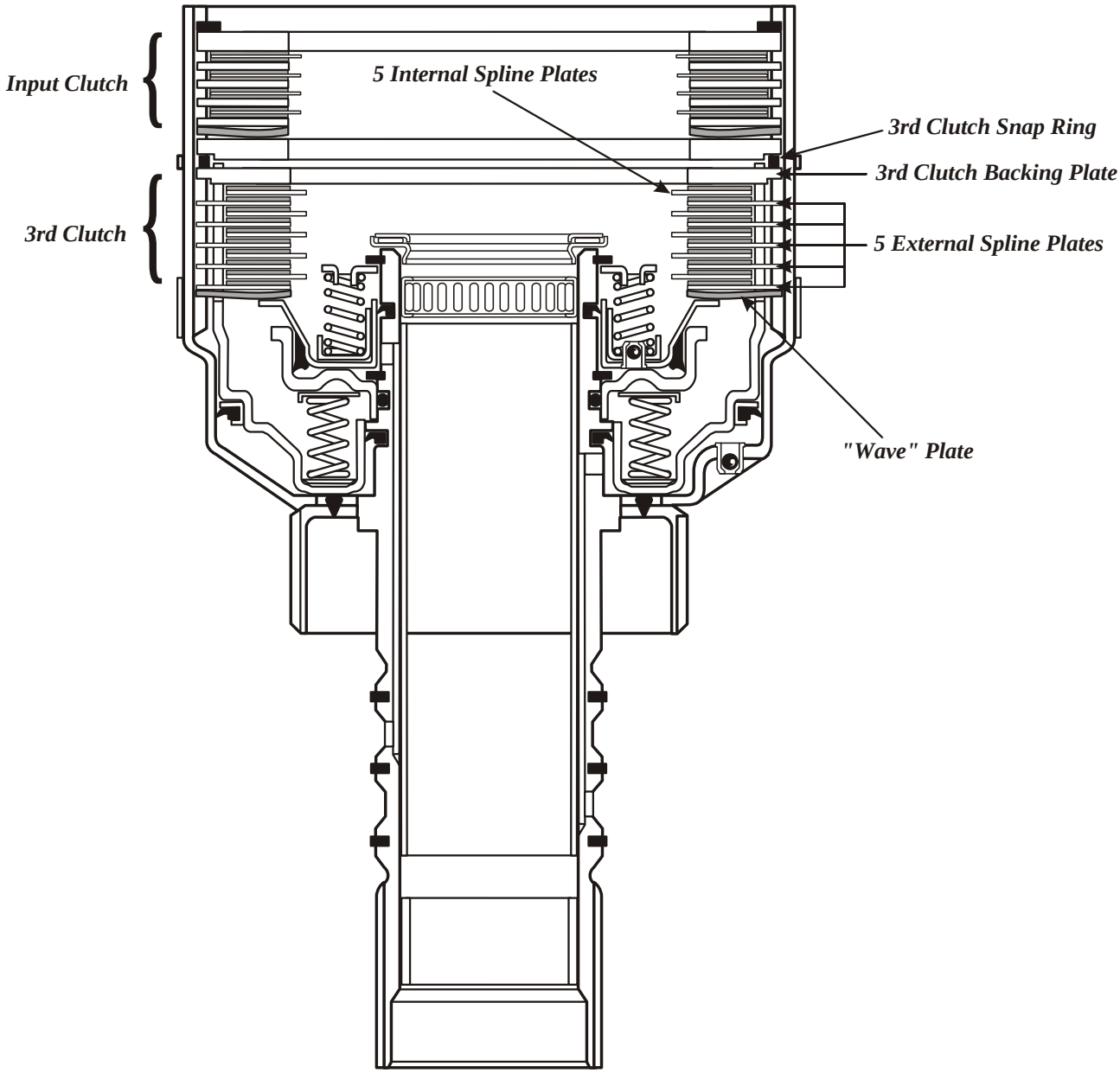


Figure 48

TYPICAL SPACER PLATE
(View from channel plate side)

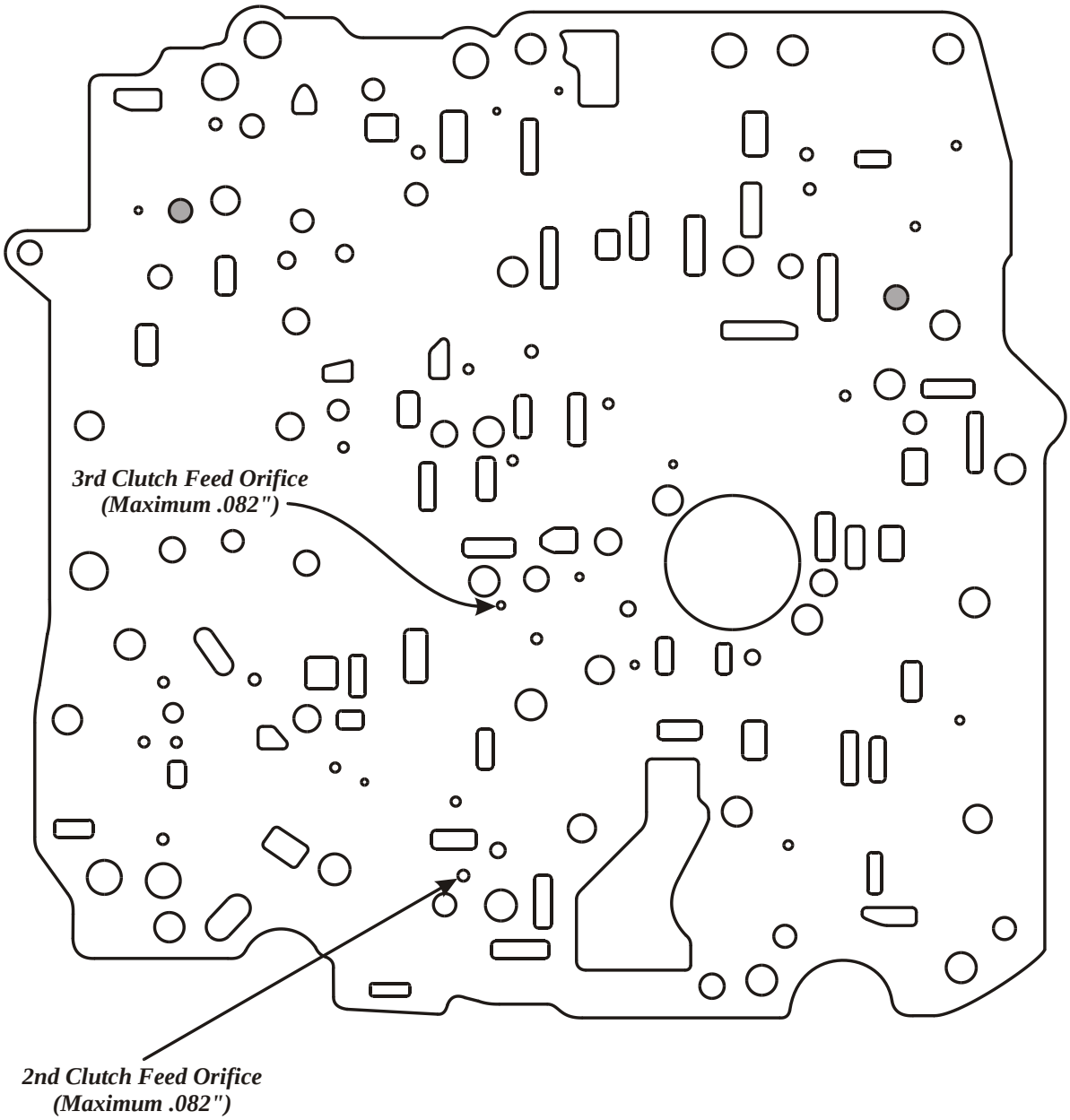


Figure 49

THM 4T65-E

2002-2003 OIL PUMP CHANGES

CHANGE: Beginning in June of 2002 Hydra-matic changed the design of the Oil Pump Assembly on 2002 and 2003 models of the 4T65-E transaxles. The "2 Piece" design level pump has been changed to a "3 Piece" design and has affected many of the related parts. The "2 Piece" design level pump is illustrated in Figure 51 and the "3 Piece" design level pump is illustrated in Figure 52.
A physical inspection of the I.D. Tag will be ***mandatory***, to obtain the update level, before ordering components for these transaxles. Refer to Figure 50 for the location of the update level on the I.D. Tag and a usage chart for design level of pump assembly.

REASON: Ease of assembly and cost savings.

PARTS AFFECTED:

(1) OIL PUMP ASSEMBLY - Changed to a "3 Piece" design, as shown in Figure 52. The "3 Piece" design now incorporates the rotor support sleeve in the pump instead of the valve body. The previous design "2 Piece design level pump is illustrated in Figure 51.

(2) OIL PUMP ASSEMBLY RETAINING BOLTS - Are a different length than the previous design level oil pump bolts.

(3) VALVE BODY ASSEMBLY - The pump rotor support sleeve has been removed from the valve body to accommodate the "3 Piece" design level pump assembly, as shown in Figure 50.

(4) PRESSURE SWITCH ASSEMBLY - Changed to a much smaller Pressure Switch Assembly with the elimination of all switches except the TCC switch, as shown in Figure 53.

(5) INTERNAL WIRE HARNESS ASSEMBLY - Changed to accommodate the 2nd design (Smaller) Pressure Switch Assembly.

(6) PRESSURE CONTROL SOLENOID - Solenoid that is much smaller than the previous design, as shown in Figure 53, for improved line pressure control.

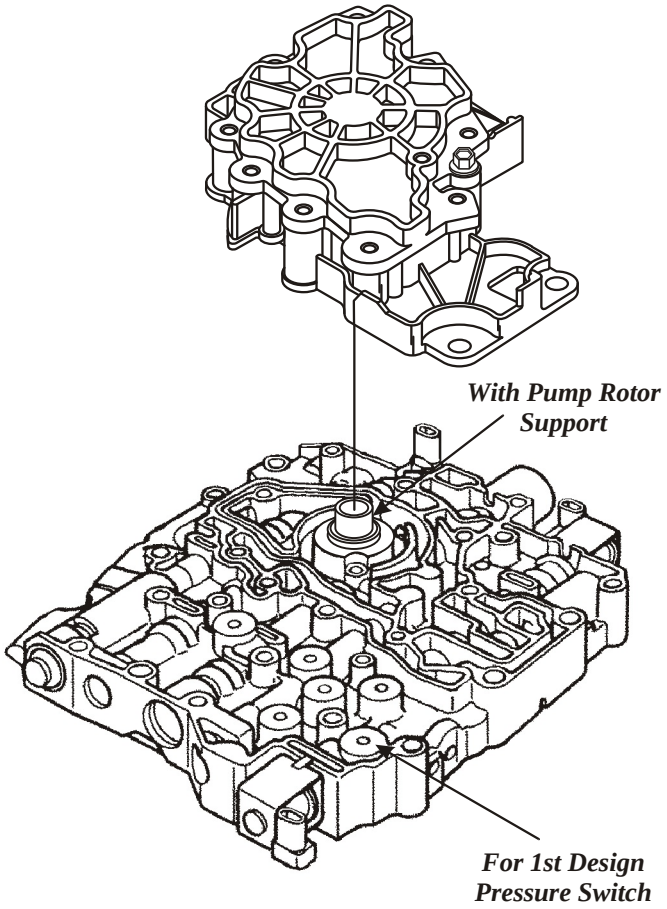
SPECIAL INFORMATION: Following are the possible combinations that you may encounter.

1. ***"2 Piece" Oil Pump and Valve Body Assembly with large 1st design Pressure Switch.***
2. ***"3 Piece" Oil Pump and Valve Body Assembly with large 1st design Pressure Switch.***
3. ***"2 Piece" Oil Pump and Valve Body Assembly with small 2nd design Pressure Switch.***
4. ***"3 Piece" Oil Pump and Valve Body Assembly with small 2nd design Pressure Switch.***

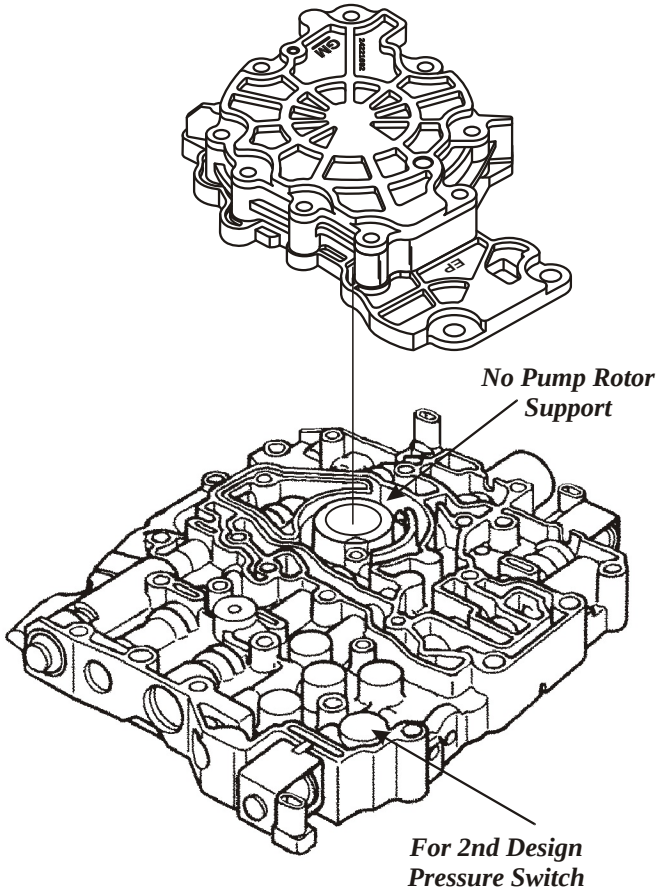
INTERCHANGEABILITY:

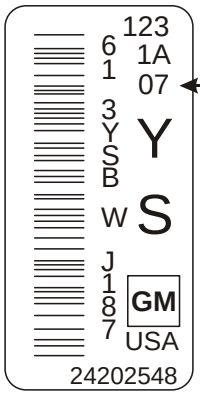
None of the parts listed above will interchange with one another. 1st design parts ***"must"*** be used together and 2nd design level parts ***"must"*** be used together.
Special Note: The physical dimensions will allow the new Pressure Control Solenoid to be installed in past models, or the previous Pressure Control Solenoid to be installed in 2003 models. ***Interchanging the Pressure Control Solenoids will result in customer dissatisfaction and additional repairs.***

1ST DESIGN "2 PIECE" PUMP AND VALVE BODY



2ND DESIGN "3 PIECE" PUMP AND VALVE BODY



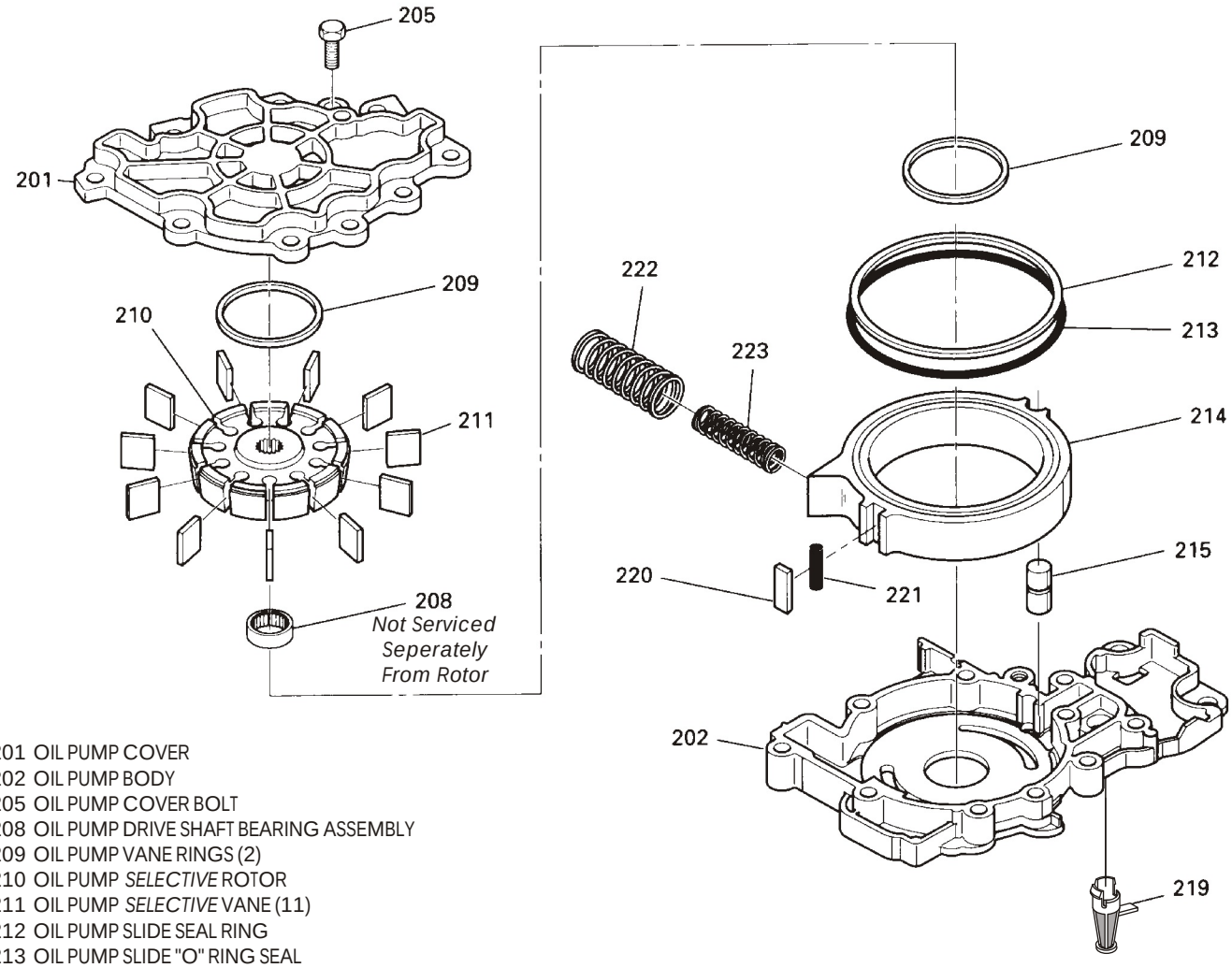


Update Level

PUMP AND VALVE BODY USAGE CHART		
Broadcast Code	***Update Level***	***Pump Style***
All 2002 Models except 2BCB, 2RNB	*Less Than 7*	*"2 Piece"*
2002 Model, 2BCB	*Less Than 4*	*"2 Piece"*
2002 Model, 2RNB	*Less Than 4*	*"2 Piece"*
All 2002 Models except 2BCB, 2RNB	*7*	*"3 Piece"*
2002 Model, 2BCB	*4*	*"3 Piece"*
2002 Model, 2RNB	*4*	*"3 Piece"*
All 2003 Models except 3BCB,	*Less Than 3*	*"2 Piece"*
2003 Model, 3BCB	*4*	*"2 Piece"*
All 2003 Models except 3BCB,	*3 And Greater*	*"3 Piece"*
2003 Model, 3BCB	*Greater Than 4*	*"3 Piece"*

Figure 50

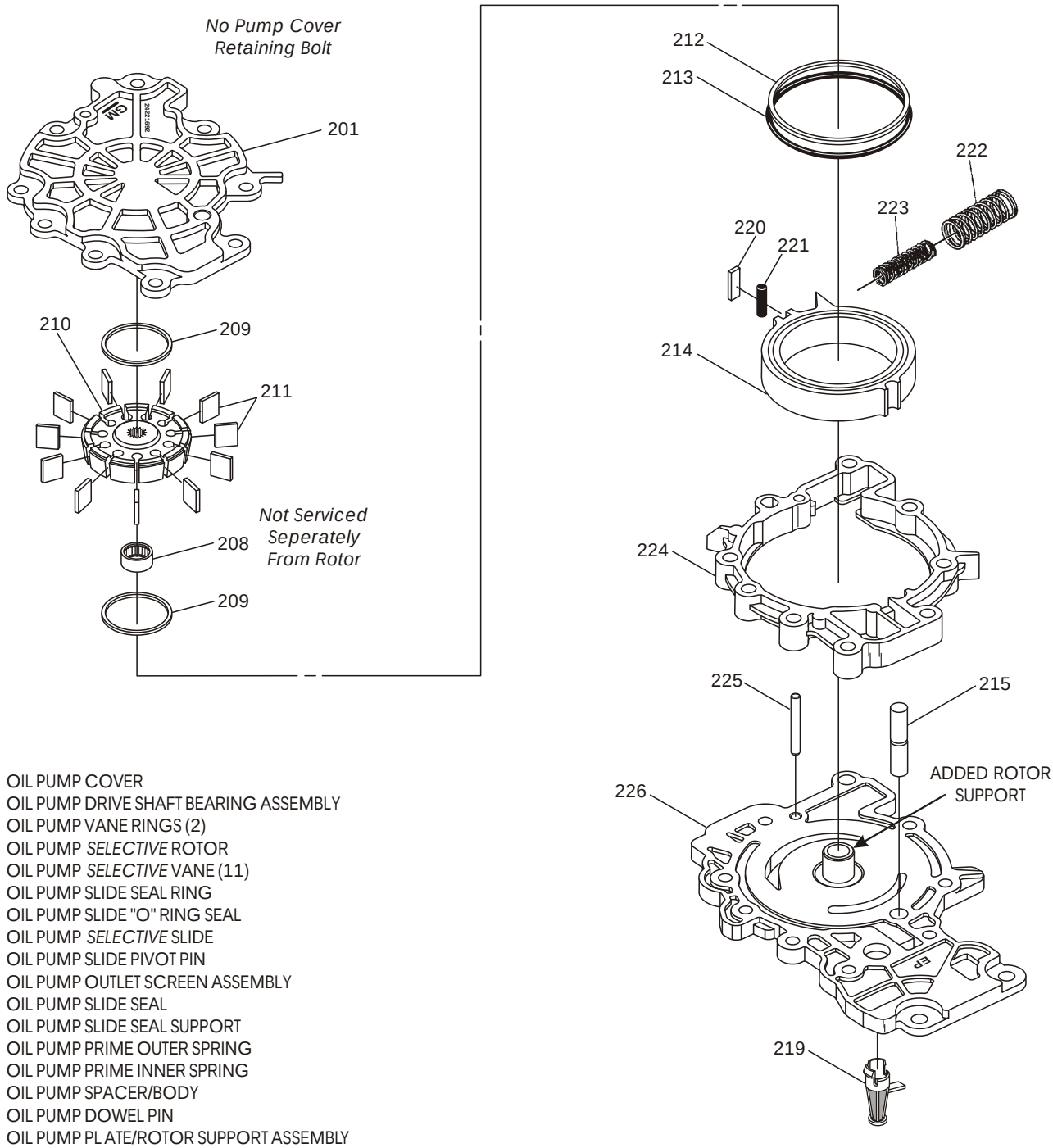
1ST DESIGN "2 PIECE"
PUMP AND VALVE BODY



201 OIL PUMP COVER
202 OIL PUMP BODY
205 OIL PUMP COVER BOLT
208 OIL PUMP DRIVE SHAFT BEARING ASSEMBLY
209 OIL PUMP VANE RINGS (2)
210 OIL PUMP *SELECTIVE* ROTOR
211 OIL PUMP *SELECTIVE* VANE (11)
212 OIL PUMP SLIDE SEAL RING
213 OIL PUMP SLIDE "O" RING SEAL
214 OIL PUMP *SELECTIVE* SLIDE
215 OIL PUMP SLIDE PIVOT PIN
219 OIL PUMP OUTLET SCREEN ASSEMBLY
220 OIL PUMP SLIDE SEAL
221 OIL PUMP SLIDE SEAL SUPPORT
222 OIL PUMP PRIME OUTER SPRING
223 OIL PUMP PRIME INNER SPRING

Figure 51

2ND DESIGN "3 PIECE" PUMP AND VALVE BODY

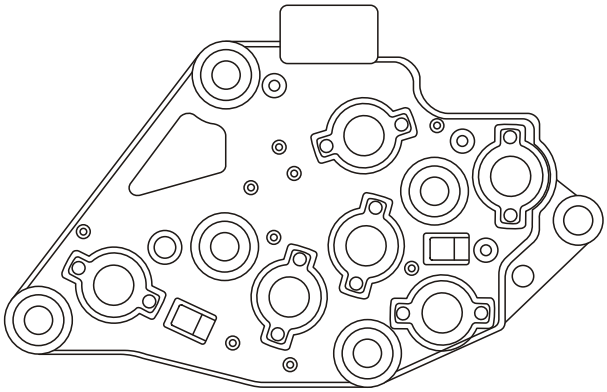


201 OIL PUMP COVER
208 OIL PUMP DRIVE SHAFT BEARING ASSEMBLY
209 OIL PUMP VANE RINGS (2)
210 OIL PUMP *SELECTIVE* ROTOR
211 OIL PUMP *SELECTIVE* VANE (11)
212 OIL PUMP SLIDE SEAL RING
213 OIL PUMP SLIDE "O" RING SEAL
214 OIL PUMP *SELECTIVE* SLIDE
215 OIL PUMP SLIDE PIVOT PIN
219 OIL PUMP OUTLET SCREEN ASSEMBLY
220 OIL PUMP SLIDE SEAL
221 OIL PUMP SLIDE SEAL SUPPORT
222 OIL PUMP PRIME OUTER SPRING
223 OIL PUMP PRIME INNER SPRING
224 OIL PUMP SPACER/BODY
225 OIL PUMP DOWEL PIN
226 OIL PUMP PL ATE/ROTOR SUPPORT ASSEMBLY

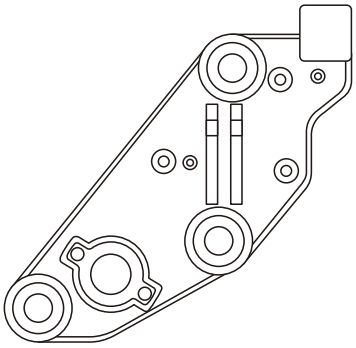
Note: The Oil Pump Retaining Bolts For This Pump Are Different Length Than For The "2 Piece" Pump.

Figure 52

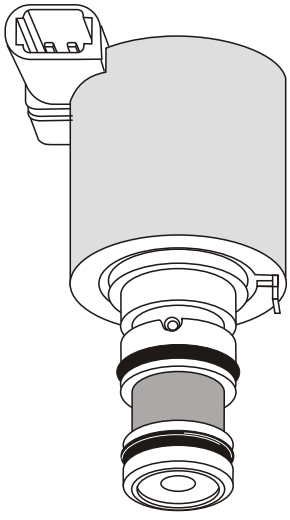
“1ST DESIGN”
PRESSURE SWITCH ASSEMBLY
PART NO. 24223197



“2ND DESIGN”
PRESSURE SWITCH ASSEMBLY
PART NO. 24216426



“1ST DESIGN”
PRESSURE CONTROL SOLENOID
PART NO. 10478146



“2ND DESIGN”
PRESSURE CONTROL SOLENOID
PART NO. 24225825

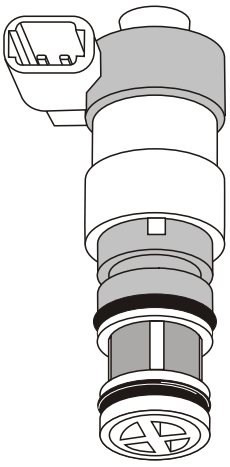


Figure 53

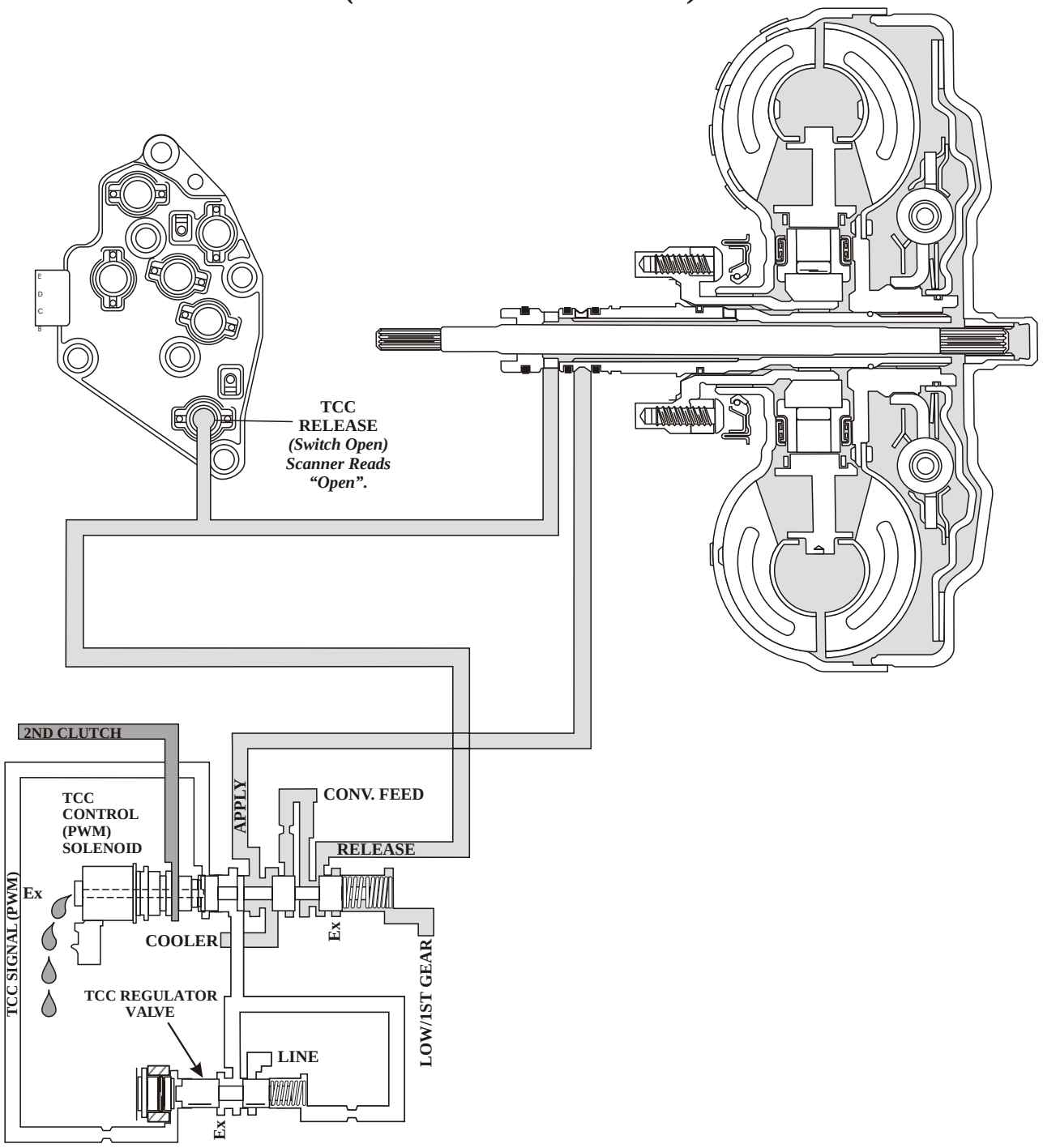
THM 4T65E
TCC SURGE AT HIGH SPEEDS OR DTC P0741

COMPLAINT: Vehicles equipped with the 4T65E transaxle may exhibit a Torque converter clutch surge at highway speeds or a Diagnostic Trouble Code P0741, TCC stuck off, before and/or after overhaul.

CAUSE: The cause may be, a leaking bore plug "O" ring on the Torque Converter Regulator Valve train. Refer to Figure 54 to see a partial hydraulic circuit of the Torque Converter Regulator valve when the TCC is released. Refer to Figure 55 to see a partial hydraulic circuit of the Torque Converter Regulator valve when the TCC is applied. Notice, when there is a leak in the TCC Signal Circuit, the torque converter regulator valve may move to the left causing insufficient converter apply pressure, allowing the Torque Converter Clutch to slip, causing a surging sensation or the P0741 code.

CORRECTION: Refer to Figure 56 and 57 for the valve locations in the valve body and replace the "O"ring on the Torque Converter Regulator Valve bore plug, item number 328, as shown in Figure 56.

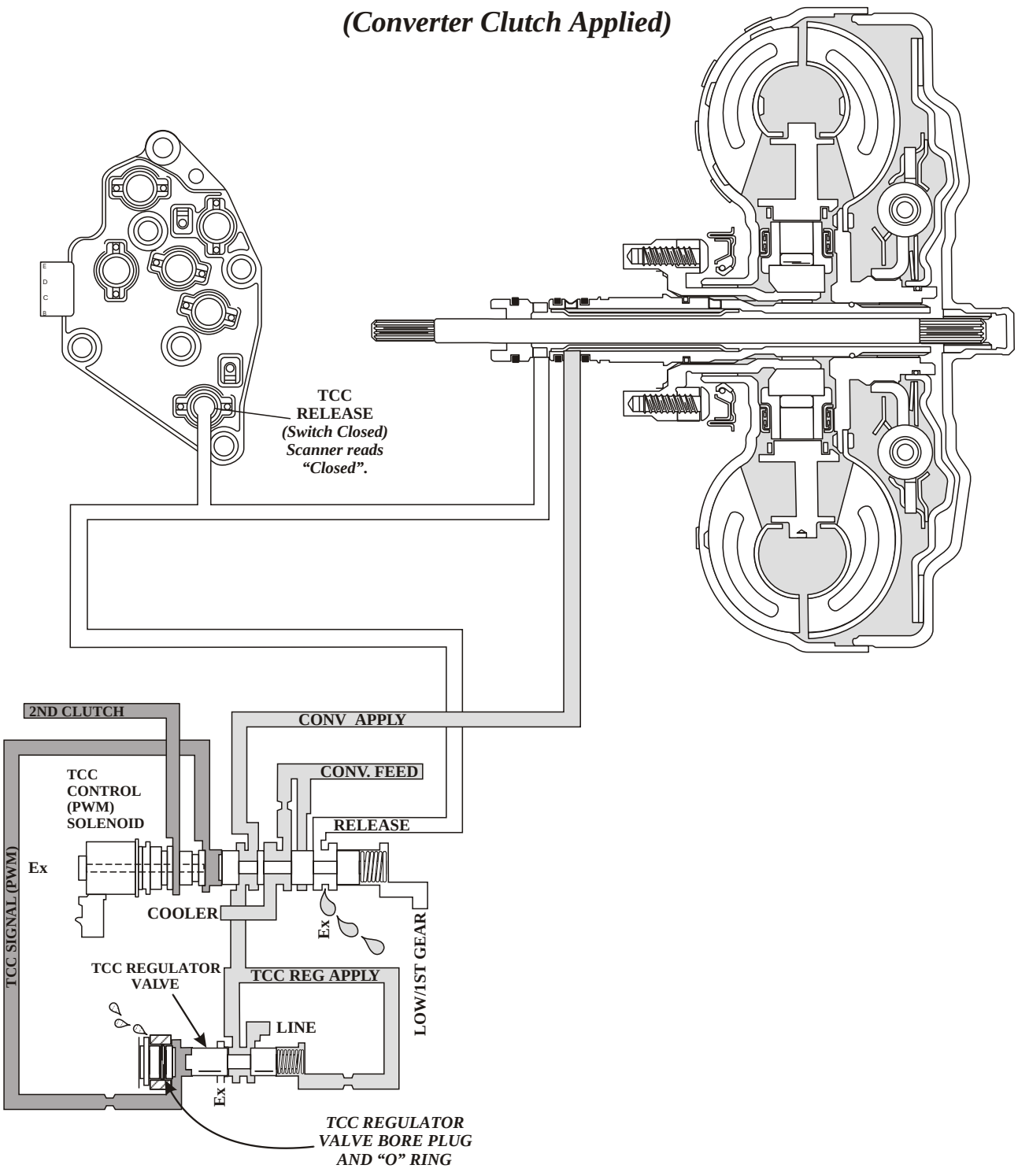
TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS
(Converter Clutch Released)



This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with the converter clutch released. Notice the TCC PWM solenoid is exhausting the TCC signal oil (2nd Clutch).

Figure 54

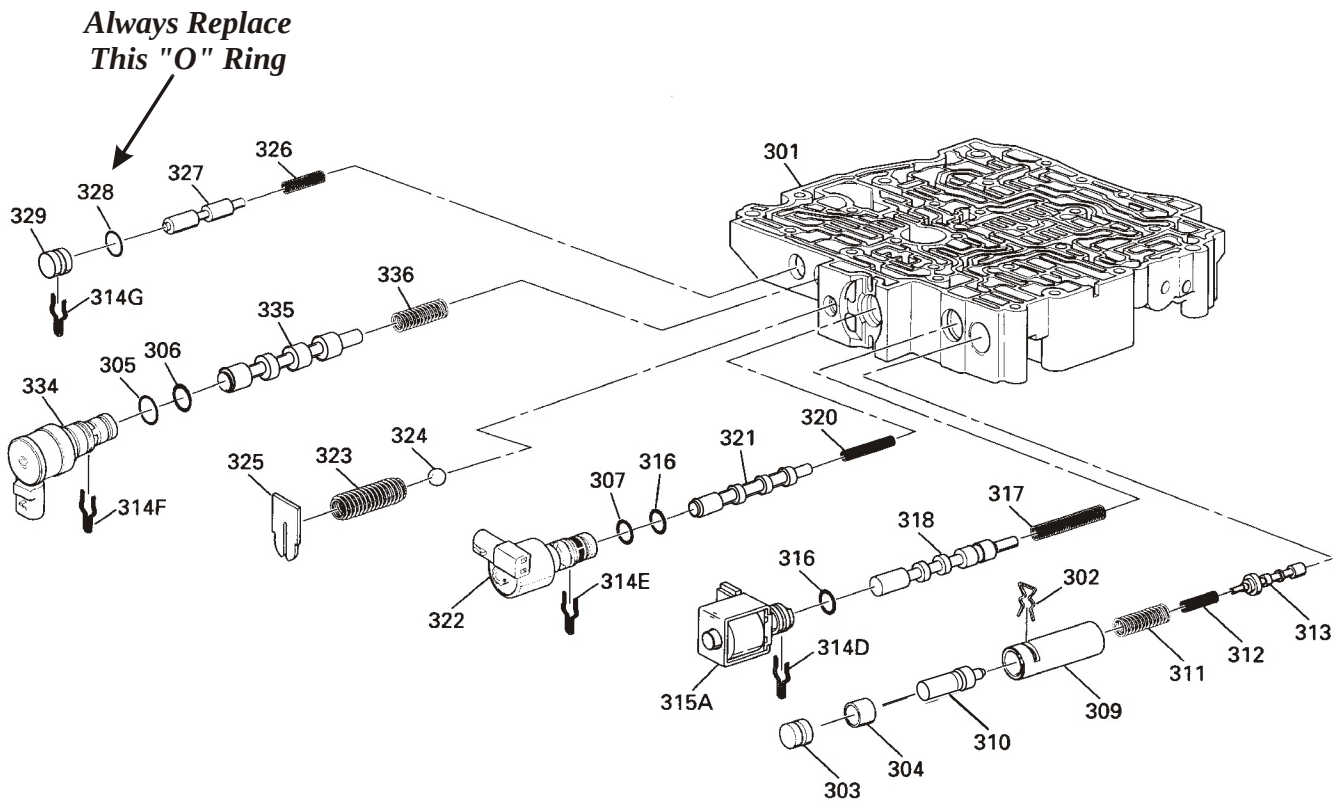
TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS
(Converter Clutch Applied)



This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with converter clutch applied. Notice the TCC PWM Solenoid is energized , and TCC signal oil is pushing TCC valve to the right. This same signal oil strokes the TCC regulator valve to the right. A leaking "O"-ring on the bore plug for the TCC regulator valve may cause the TCC regulator valve to limit the amount of converter apply pressure by allowing the valve to move to the left.

Figure 55

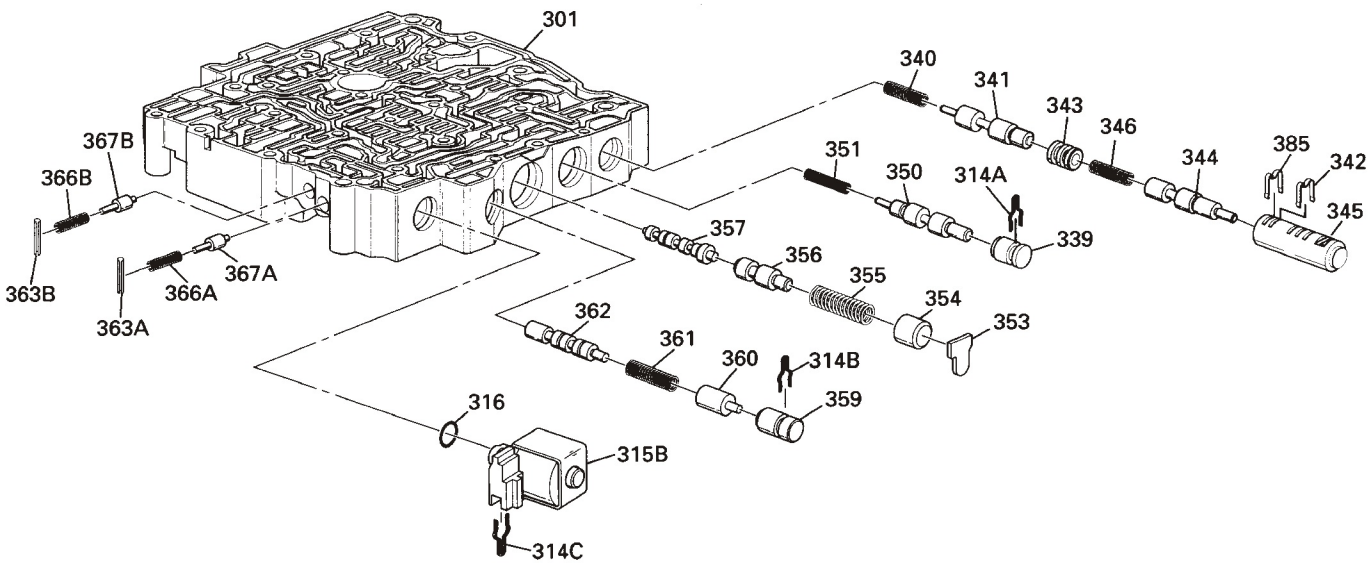
VALVE BODY IDENTIFICATION



301 CONTROL VALVE BODY
302 LINE BOOST VALVE AND BUSHING RETAINER
303 LINE BOOST VALVE BORE PLUG
304 LINE BOOST VALVE
305 TCC PWM SOLENOID "O" RING SEAL
306 TCC PWM SOLENOID "O" RING SEAL
307 PRESSURE CONTROL SOLENOID "O" RING SEAL
309 REVERSE BOOST VALVE BUSHING
310 REVERSE BOOST VALVE
311 PRESSURE REGULATOR VALVE OUTER SPRING
312 PRESSURE REGULATOR VALVE INNER SPRING
313 PRESSURE REGULATOR VALVE
314D 1-2, 3-4 SHFIT SOLENOID RETAINER
314E PRESSURE CONTROL SOLENOID RETAINER
314F TCC PWM SOLENOID RETAINER
314G TCC REGULATOR APPLY VALVE BORE PLUG RETAINER
315A 1-2, 3-4 SHIFT SOLENOID ASSEMBLY
316A 1-2, 3-4 SHIFT SOLENOID "O" RING SEAL
317 1-2 SHIFT VALVE SPRING
318 1-2 SHIFT VALVE
320 TORQUE SIGNAL REGULATOR VALVE SPRING
321 TORQUE SIGNAL REGULATOR VALVE
322 PRESSURE CONTROL SOLENOID ASSEMBLY
323 LINE PRESSURE RELIEF VALVE SPRING
324 LINE PRESSURE RELIEF VALVE
325 LINE PRESSURE RELIEF VALVE SPRING RETAINER
326 TCC REGULATOR APPLY VALVE SPRING
327 TCC REGULATOR APPLY VALVE
328 TCC REGULATOR APPLY VALVE BORE PLUG "O" RING SEAL
329 TCC REGULATOR APPLY VALVE BORE PLUG
334 TCC PWM SOLENOID ASSEMBLY
335 TCC CONTROL VALVE
336 TCC CONTROL VALVE SPRING

Figure 56

VALVE BODY IDENTIFICATION



301 CONTROL VALVE BODY
314A 1-2, 3-4 ACCUMULATOR VALVE RETAINER
314B 4-3 MANUAL DOWNSHIFT VALVE RETAINER
314C 2-3 SHIFT SOLENOID RETAINER
315B 2-3 SHIFT SOLENOID ASSEMBLY
316 2-3 SHIFT SOLENOID "O" RING SEAL
339 1-2 ACCUMULATOR VALVE BORE PLUG
340 3-4 ACCUMULATOR VALVE SPRING
341 3-4 ACCUMULATOR VALVE
342 2-3 ACCUMULATOR VALVE BUSHING RETAINER
343 2-3 ACCUMULATOR VALVE BORE PLUG
344 2-3 ACCUMULATOR VALVE
345 2-3 ACCUMULATOR VALVE BUSHING
346 2-3 ACCUMULATOR VALVE SPRING
350 1-2 ACCUMULATOR VALVE
351 1-2 ACCUMULATOR VALVE SPRING
353 3-2 MANUAL DOWNSHIFT VALVE RETAINER
354 3-2 MANUAL DOWNSHIFT VALVE BORE PLUG
355 3-2 MANUAL DOWNSHIFT VALVE SPRING
356 3-2 MANUAL DOWNSHIFT VALVE
357 2-3 SHIFT VALVE
359 4-3 MANUAL DOWNSHIFT VALVE BORE PLUG
360 4-3 MANUAL DOWNSHIFT VALVE
361 4-3 MANUAL DOWNSHIFT VALVE SPRING
362 3-4 SHIFT VALVE
363A REVERSE SERVO BOOST VALVE BORE ROLL PIN
363B FORWARD SERVO BOOST VALVE BORE ROLL PIN
366A REVERSE SERVO BOOST VALVE SPRING
366B FORWARD SERVO BOOST VALVE SPRING
367A REVERSE SERVO BOOST VALVE
367B FORWARD SERVO BOOST VALVE
385 2-3 ACCUMULATOR VALVE RETAINER

Figure 57

THM 4T65-E

DTC P0742 TCC STUCK "ON"

COMPLAINT: Before or after overhaul, a vehicle equipped with the THM 4T65E automatic transaxle, logs OBDII code P0742 “TCC Stuck On”. When this code is set, the PCM will command TCC on at full capacity, and also freeze the shift adapt strategy.

CAUSE:

(1) This condition may be caused ***mechanically*** by a sticking or defective TCC release switch located in the pressure switch assembly

(2) This problem may be caused ***electrically*** by a short to ground of the TCC release switch, or the external wire from PCM to terminal "U" at the case connector, or the internal wire from terminal "U" to terminal "B" on the pressure switch assembly.

(3) This condition may be caused ***hydraulically*** by a clogged TCC PWM solenoid.
Note: Installing a TCC PWM solenoid from a 4L60E on this vehicle will react the same as a clogged solenoid. (TCC immediately on top of 2nd gear).

CORRECTION: To correct this problem it must first be established whether the trouble is mechanical, hydraulic, or electrical in nature before the problem can be resolved and most scanners no longer give you TCC release switch information.

Pressure Switch Operation And Function:

The pressure switch assembly located on the valve body of the 4T65E transaxle, is a switch assembly containing six fluid pressure switches. Three of these pressure switches; (D4, LO, and REV), are normally open switches, while the other three switches; (D3, D2, and TCC Release) are normally closed switches. These switches with the exception of the TCC Release switch are used by the PCM to determine the position of the Manual Valve in the transmission. The TCC Release switch, which is the one we are interested in, is normally closed and completed to ground and is used as an additional aid for the PCM to confirm the ON/OFF status of the Torque Converter Clutch during operation of the vehicle.

Diagnosis Procedure:

(1) Back probe terminal "U" with the positive lead from DVOM, as shown in Figure 59(Upper), and the negative lead from DVOM to a known good ground.

(2) Observe the DVOM. We should have continuity at this point, since we now know that the TCC Switch is normally closed and completed to ground.

(3) Start the engine leaving the selector lever in the Park position. TCC release oil should now open the normally closed switch and we should show no continuity on the DVOM. This would mean that the switch and wiring is operating properly and the most likely problem is the TCC/PWM solenoid clogged or restricted. If you still show continuity, with the engine running, continue to step (4).

(4) Turn the engine off and disconnect the vehicle harness connector from the transaxle. Locate the vehicles PCM, locate and disconnect the “Clear” C2 connector at the PCM.
(Refer to appropriate service manual for exact location of PCM as location will vary model to model).

Continued on next Page

Diagnosis Procedure: (Cont'd)

(5) Connect the positive lead from DVOM to terminal "U" on the vehicle harness connector, as shown in Figure 59 (Lower), and the negative lead from DVOM to a known good ground.

(6) There should be no continuity on the DVOM. If you do have continuity, the wire from the transaxle case connector to the PCM is grounded and ***must*** be repaired or replaced. If you do not have continuity, continue to step (7).

(7) You now have it narrowed down to the Pressure Switch Assembly (PSA) with a defective TCC switch, or an internal wiring harness that is grounded internally. Either way we have to take it apart.

(8) To check the internal harness for a short to ground, refer to Figure 60. To check the Pressure Switch Assembly, refer to Figure 61.

SPECIAL NOTE:

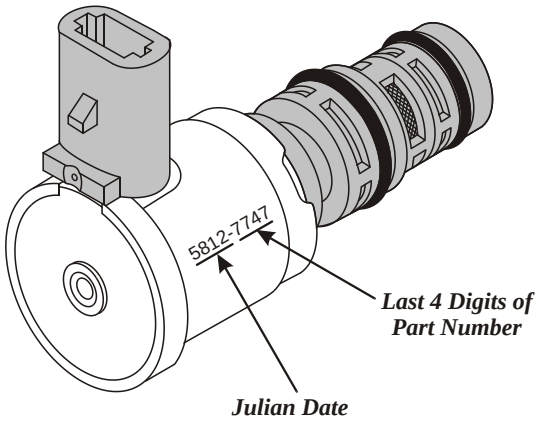
1. For Pressure Switch Assembly description and operation, refer to Figure 62.
2. If you are trying to diagnos the TCC Release switch using a scanner, refer to Figure 63, as all scanners are not capable of viewing the TCC switch.
3. Refer to Figure 64, 65, and 66 for hydraulic schematics of the TCC circuit in various configurations.

SERVICE INFORMATION:

TCC/PWM Solenoid 24227747
(Refer to Figure 58 for ***positive*** I.D.)

TCC SOLENOID IDENTIFICATION

4T65-E Only



4T40/45E, 4T80E, 4L60/65E Only (Cannot Be Used On 4T65E)

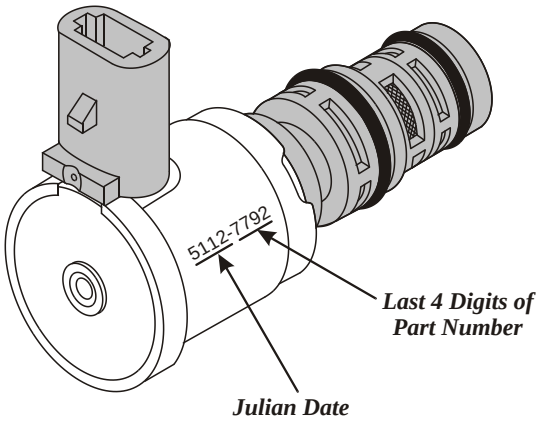
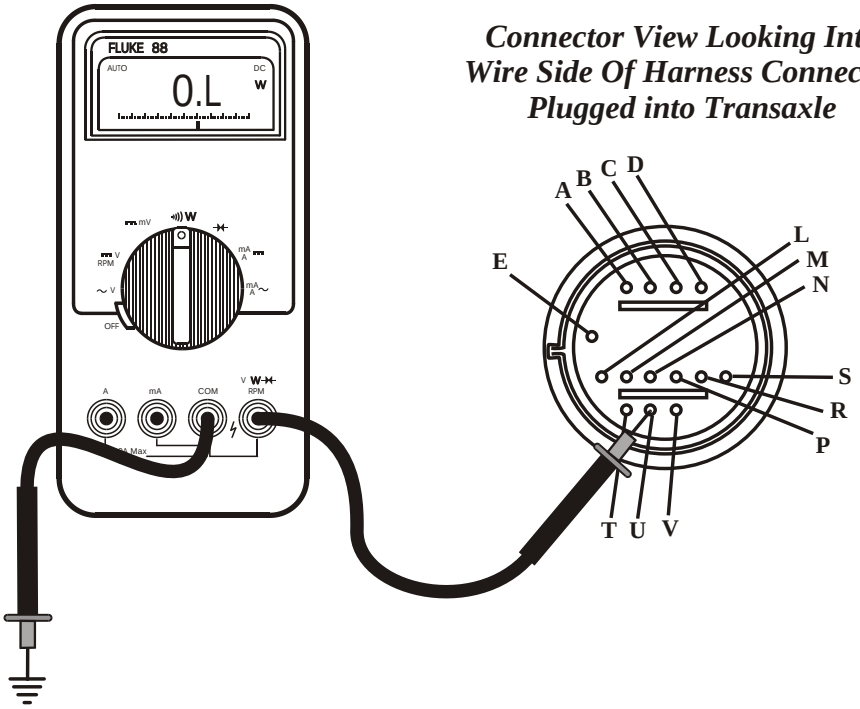
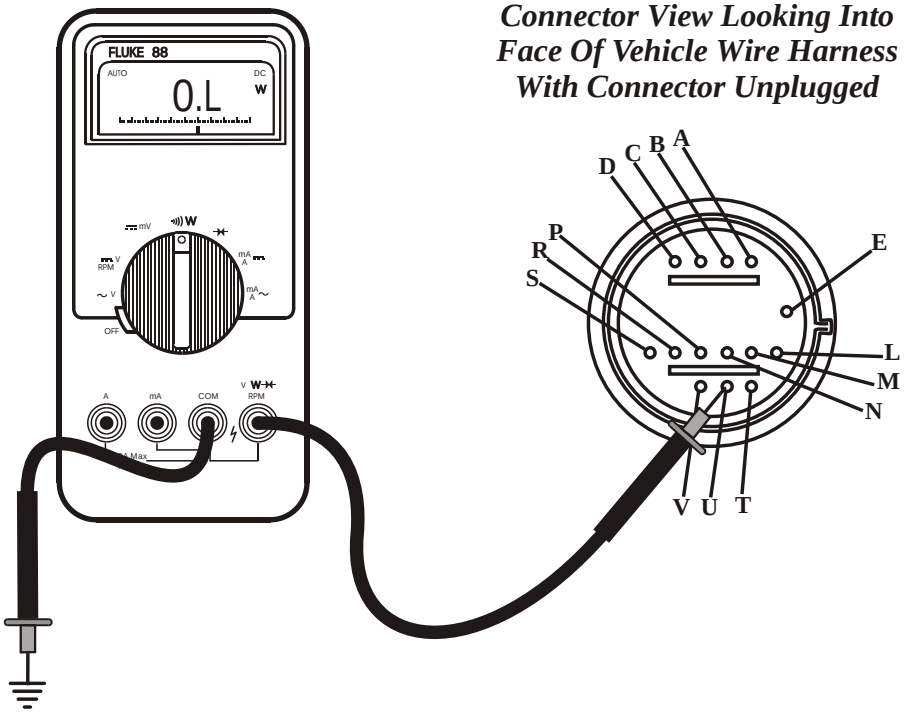


Figure 58



Connector View Looking Into Wire Side Of Harness Connector Plugged into Transaxle

CHECKING FOR GROUNDED WIRE FROM PCM TO TRANSAXLE CASE CONNECTOR



Connector View Looking Into Face Of Vehicle Wire Harness With Connector Unplugged

Figure 59

CHECKING INTERNAL WIRE HARNESS

Diagnosis Procedure:

(1) Disconnect the Pressure Switch Assembly (PSA) connector from the Pressure Switch Assembly, as shown below.

(2) Connect the positive lead from DVOM to terminal "B" on the PSA connector, as shown below, and the negative lead from DVOM to a good ground, such as valve body or oil pump.

(3) There should not be continuity. If you do have continuity, it will be necessary to replace the Internal Wire Harness. If there is no continuity Internal harness is OK.

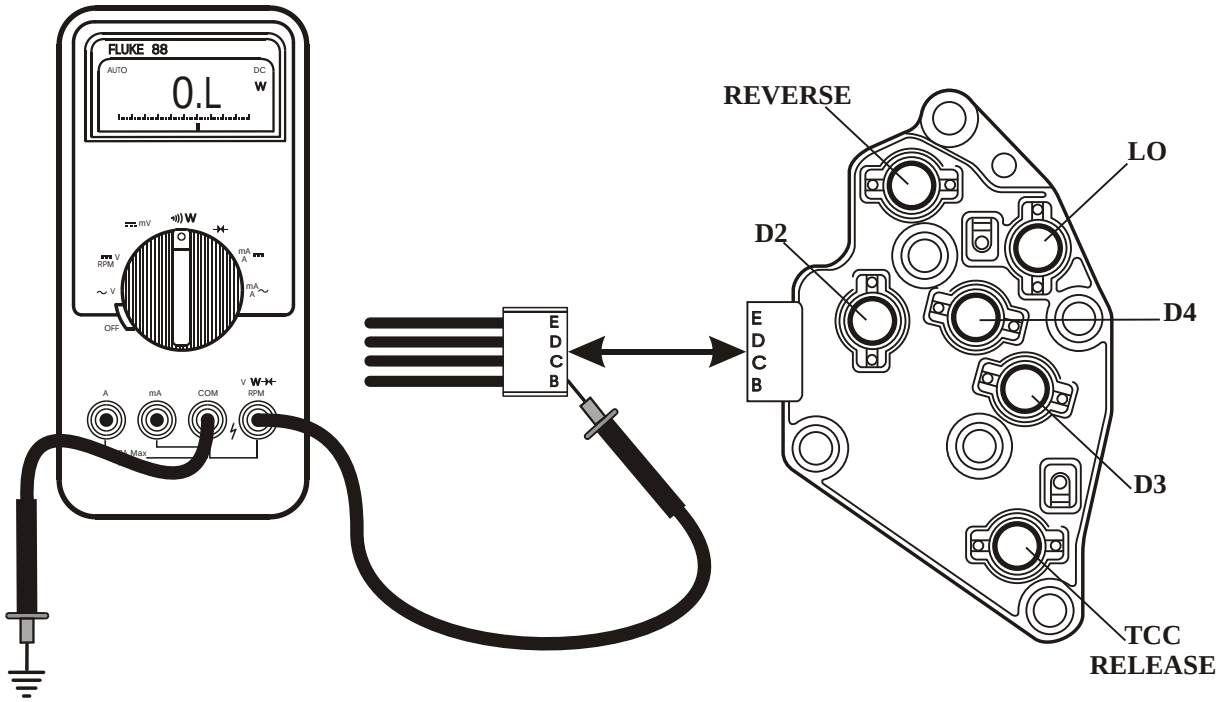


Figure 60

CHECKING THE PRESSURE SWITCH ASSEMBLY

Diagnosis Procedure:

(1) Remove the Pressure Switch Assembly (PSA) and place it on a flat work surface, as shown below.

(2) Using the DVOM, set the meter to check for continuity or resistance, place the positive lead of the meter on Terminal "B" at the PSA connector and place the negative lead of the meter to the metal contact of the TCC Release Switch, as shown below.

(3) The meter should indicate continuity, or approximately .5 ohms resistance. Press down firmly in the center of the switch contact, using the eraser end of a pencil, and check the meter again. The meter should now indicate no continuity, or an open circuit. If the meter does not indicate an open circuit, after pressing the switch contact, replace the Pressure Switch Assembly.

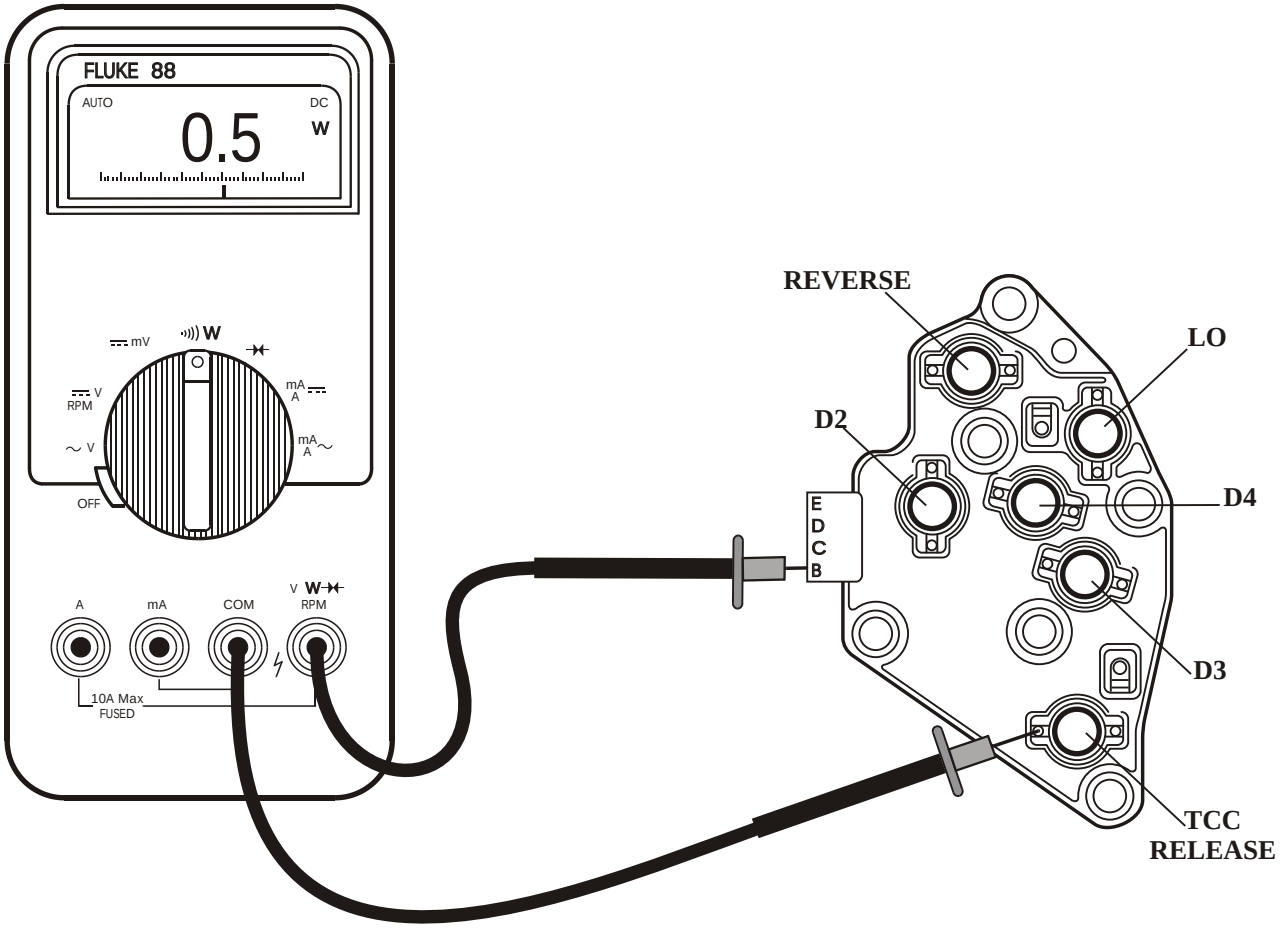


Figure 61

PRESSURE SWITCH ASSEMBLY DESCRIPTION AND OPERATION

The Pressure Switch Assembly (PSA) located on the valve body of the 4T65E transaxle, is a switch assembly containing six fluid pressure switches. Three of these pressure switches; (D4, LO, and REV), are normally open switches, while the other three switches; (D3, D2, and TCC Release) are normally closed switches. These switches with the exception of the TCC Release switch are used by the PCM to determine the position of the Manual Valve in the transmission. The TCC Release switch, which is the one we are interested in, is used as an additional aid for the PCM to confirm the ON/OFF status of the Torque Converter Clutch during operation of the vehicle.
Figure 63 on the following page illustrates the indications shown on a scan tool in each range when checking the range parameters E, D, C, and TCC Release. "HI" indicates the switch is open, while "LO" indicates the switch is closed when viewing the datastream on the scanner.

All scanners do not have the capability of viewing the TCC Release Switch!!!

Note: When viewing scanner parameter for TCC Release, the indication on the scan tool may show a; ("0" open) and ("1" closed), or ("P2" open) and ("P1" closed), or ("HI" open) and ("LO" closed), depending on the scanner manufacturer.

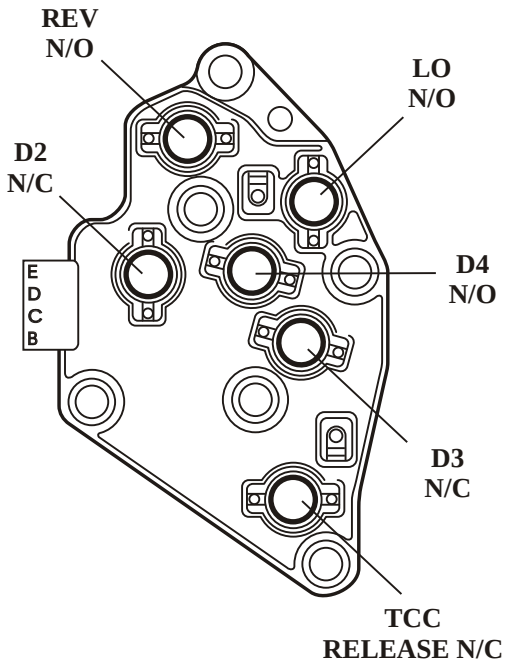


Figure 62

RANGE INDICATOR	CIRCUIT			
	E	D	C	TCC
PARK/NEUTRAL	HI	LO	HI	HI
REVERSE	LO	LO	HI	HI
OVERDRIVE	HI	LO	LO	*
MANUAL THIRD	HI	HI	LO	*
MANUAL SECOND	HI	HI	HI	*
MANUAL FIRST	LO	HI	HI	HI

TCC Release Switch information is not available on all scanners.

HI = Indicates an open switch as identified on the scanner.
LO = Indicates a closed switch as identified on the scanner.
**** = Indicates wether TCC release oil is present (HI), or not present (LO).***
TCC On will = (LO).
TCC Off will = (HI).

Connect the scanner and locate the parameter for TCC release. The TCC release switch in the pressure switch assembly is a normally closed switch. The switch is held open by the presence of torque converter release pressure at the switch. Refer to Figure 62 for description and operation of the PSA. With the scanner connected and the vehicle started in park, the indication on the scanner should show the switch to be open, as release oil should be present. Depending on the scanner, the indication shown may : (“0”-open) and (”1”-closed), (”P2”-open) and (”P1”-closed) or (”HI"-open) and (”LO”-closed). Refer to the chart above for the pressure switch assembly readings on the scanner.

If the scanner shows the switch to be closed, the trouble will be caused by either a stuck TCC release switch, or a short to ground on the signal wire from the TCC release switch to the computer. Refer to Figure 59 to check for a shorted wire in the TCC release switch circuit. Refer to Figure 60 to check for shorted internal harness Refer to Figure 61 to check for a stuck TCC release switch.

If the indication on the scanner shows the switch to be open, hold the brake and place the selector lever in the drive position. Allow the wheels to spin and watch the scanner as the vehicle up-shifts into second gear. If the indication on the scanner changes from open to closed with the shift into second gear, check the parameter for TCC duty cycle and see what the reading shows. A reading of 0% duty cycle would indicate that the computer has not commanded lock-up. If the computer has not commanded lock-up, but TCC release oil has exhausted, (noted by the change in state of the TCC release switch on the scanner), could indicate a clogged TCC PWM solenoid. Refer to Figures 64, 65, and 66 for TCC PWM hydraulic circuit description.

CAUTION:

A vehicle equipped with ABS "CANNOT" be run on a lift.

Figure 63

DESCRIPTION OF THE 3 FOLLOWING PARTIAL HYDRAULIC SCHEMATICS

The hydraulic diagram shown in Figure 64 represents the transmission in either; Park, Reverse, Neutral, or Drive 1st. Gear, including Manual Low. When you look at the feed from second gear to the TCC PWM solenoid, you will notice the lack of oil pressure in the circuit. This is because oil pressure is present only when the second clutch is applied, which would be 2nd, 3rd, and 4th gears on this transaxle. With no oil pressure at the second clutch, the TCC control valve stays at rest in it's bore away from the spring. This results in oil pressure being present at the TCC Release Switch in the Pressure Switch Assembly, keeping the Release Switch open.

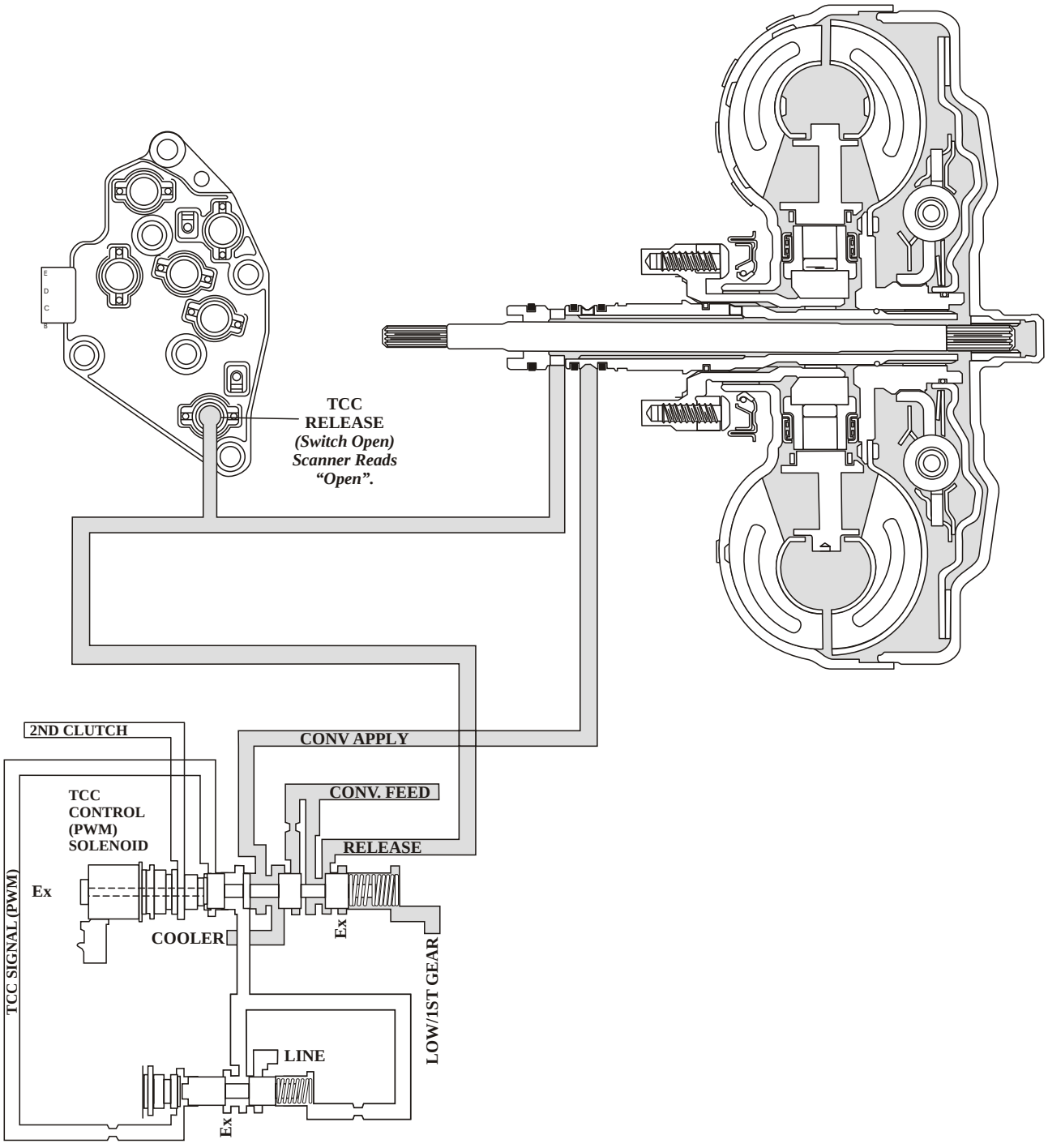
The hydraulic diagram shown in Figure 65 represents the transmission in Drive 2nd. Gear, 3rd. Gear, and 4th. Gear. Notice the presence of 2nd gear oil pressure in the circuit. With the solenoid "OFF" and not energized, the solenoid should exhaust 2nd clutch pressure so that the pressure in the solenoid doesn't become great enough to cause the TCC valve to stroke inward against the spring. Lock-up will not be engaged at this time.

The hydraulic diagram shown in Figure 66 also represents the transmission in Drive 2nd. Gear, 3rd. Gear, and 4th. Gear, lock-up clutch applied. If for some reason the TCC solenoid is not capable of exhausting 2nd clutch oil pressure, the result will be the TCC control valve overcoming spring tension and moving into the lock-up position. Lock-up release oil will exhaust through the valve, the converter clutch will engage with the shift into second gear. Replacing the TCC PWM solenoid should correct the problem.

It has been found that although identical in appearance, a new factory TCC PWM solenoid for the 4L60E has been used in the 4T65E in different instances. Even though the solenoids look identical, they ***"Will Not" interchange.***

CAUTION:
Use "ONLY" the TCC PWM Solenoid for a 4T65-E transaxle, identified by the part number on the canister for identification, and available under OEM part number 24227747, which supercedes all previous part numbers. Refer to Figure 58.

TCC HYDRAULIC CIRCUIT IN PARK, REVERSE, NEUTRAL AND DRIVE 1ST. GEAR

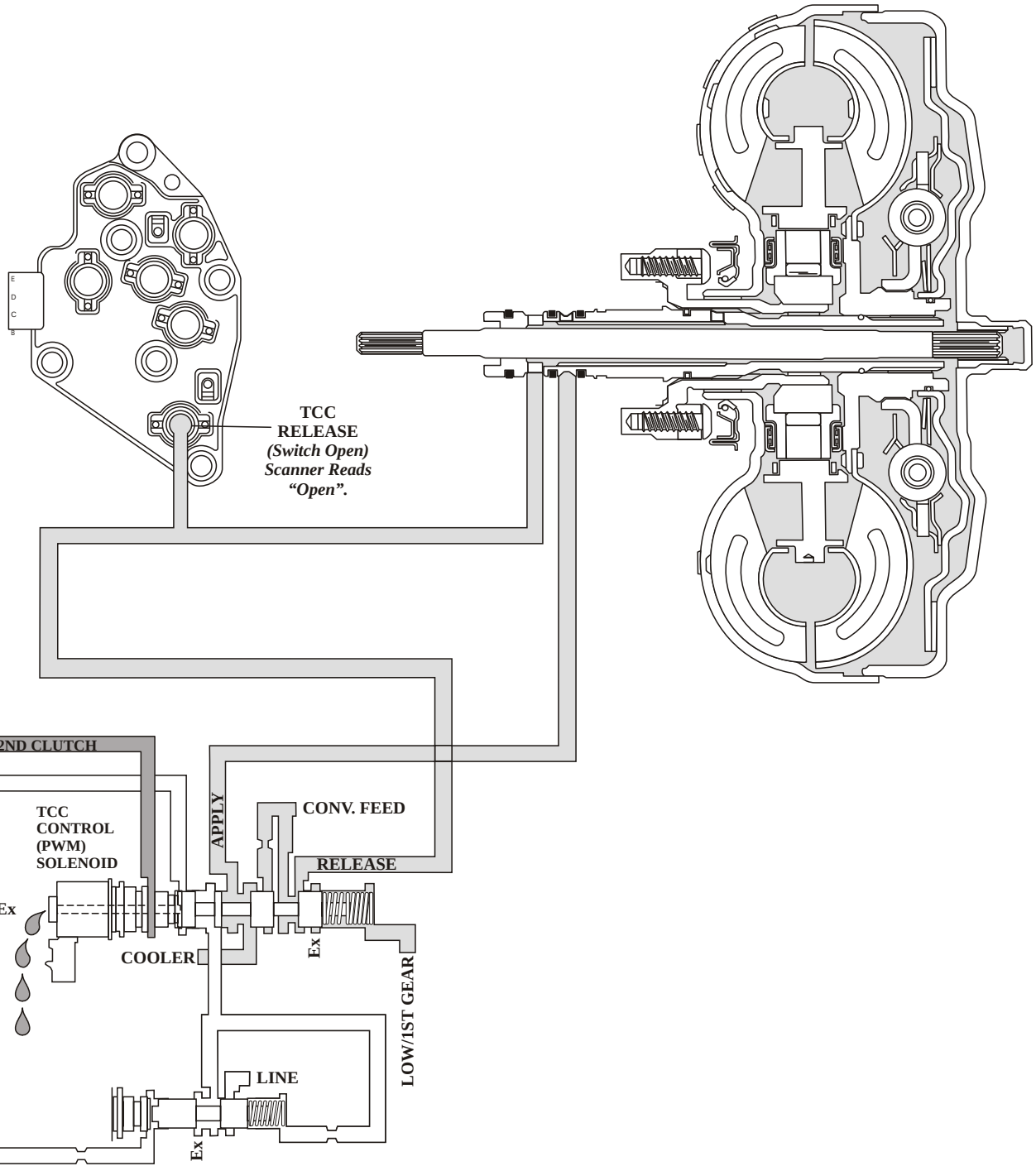


This diagram shows the transmission in either Park, Reverse, Neutral, or Drive 1st gear including Manual Low.

Notice that Lo/1st oil is routed to the spring side of the TCC valve and with no second clutch oil fed to the TCC/PWM solenoid, converter clutch apply is prevented

Figure 64

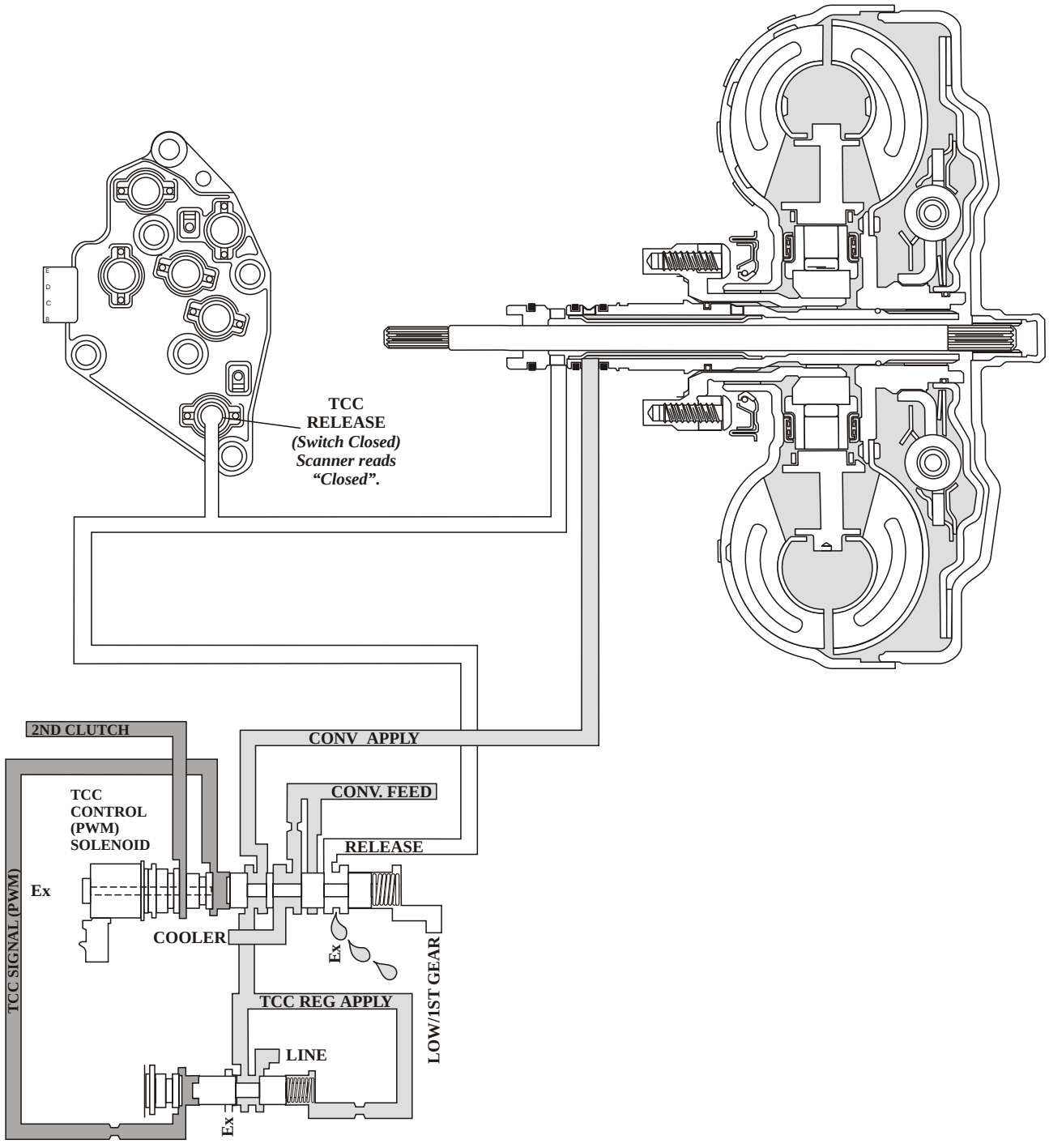
TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS
(Converter Clutch Released)



This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with converter clutch released. Notice the TCC PWM solenoid is exhausting the TCC signal oil (2nd Clutch) and pressure is not high enough to overcome spring pressure on the TCC valve, so the release oil is not exhausted.

Figure 65

TCC HYDRAULIC CIRCUIT IN DRIVE 2ND 3RD AND 4TH GEARS
(Converter Clutch Applied)



This diagram shows the transmission in 2nd, 3rd, or, 4th gear, with converter clutch applied. Notice the TCC PWM Solenoid is energized and not exhausting the TCC signal oil, (2nd Clutch) and TCC signal oil is pushing TCC valve to the right, causing release oil to exhaust at the valve.

Figure 66

THM 4T65-E

FORWARD & REVERSE SERVO BOOST VALVES ELIMINATED

CHANGE: At the start of production for the 2000 model year, the forward and reverse servo boost valves were eliminated from the valve body.

REASON: The purpose of the forward and reverse servo boost valves is to act as accumulators to cushion forward and reverse engagement. The valves are redundant and were therefore eliminated as a cost savings measure.

PARTS AFFECTED:

(1) SERVO BOOSTVALVES - Complete valve trains eliminated, as shown in Figure 68.

(2) VALVE BODY CASTING - Servo boost valve bores are now cast shut, as shown in Figure 68.

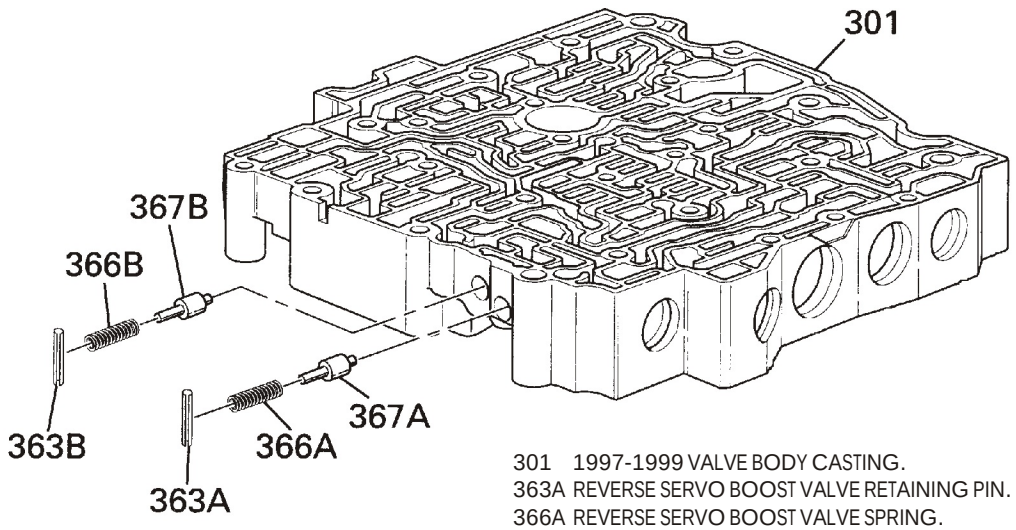
INTERCHANGEABILITY:

The valve body, with or without the forward and reverse servo boost valves may be used in any 4T65-E transaxle, as long as Pressure Switch Assembly, Pressure Control Solenoid, and the valve body calibration match the vehicle application. There were no changes in Spacer Plate or gaskets.

SERVICE INFORMATION:

Refer to Page 56 in this manual for information concerning the Pressure Control Solenoid and Fluid Pressure Switch usage mentioned under interchangeability above.

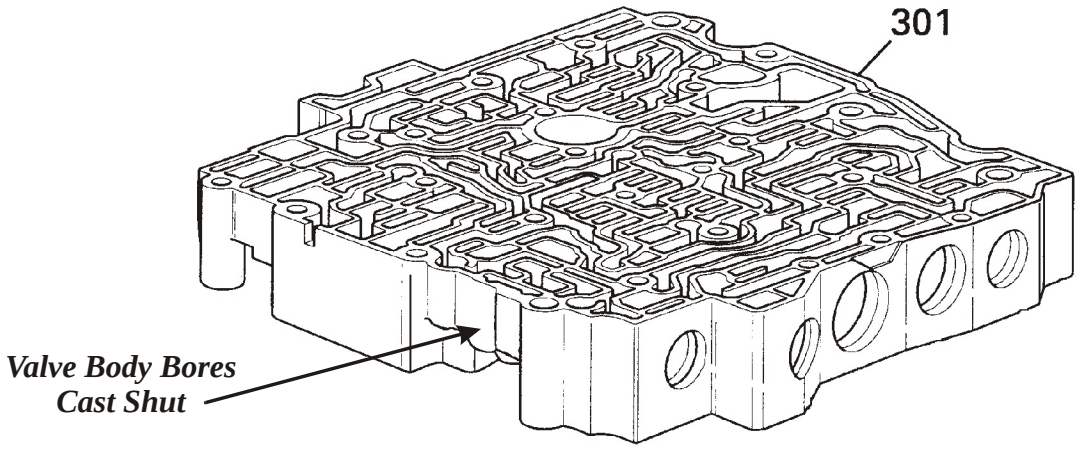
1997-1999 VALVE BODY CASTING



301 1997-1999 VALVE BODY CASTING.
363A REVERSE SERVO BOOST VALVE RETAINING PIN.
366A REVERSE SERVO BOOST VALVE SPRING.
367A REVERSE SERVO BOOST VA;VE.
363B FORWARD SERVO BOOST VALVE RETAINING PIN.
366B FORWARD SERVO BOOST VALVE SPRING.
367B FORWARD SERVO BOOST VALVE.

Figure 67

2000-UP VALVE BODY CASTING



301 2000-UP VALVE BODY CASTING.

Figure 68

THM 4T65-E
BROKEN SIDE COVER

COMPLAINT: Vehicle returns after rebuild with a fluid leak. After investigation, you discover that the structural side cover is cracked around one of the three retaining bolt locations, shown on the gasket, in Figure 69.

CAUSE: The cause may be, the structural side cover retaining bolts were not torqued properly.

CORRECTION: Torque the structural side cover retaining bolts to 25 N·m (18 ft.lb.).
Explanation: The three gasket bolt hole locations, shown in Figure 69, do not have any metal support around the inside perimeter of the gasket, on the side the arrows are on. This allows zero support on the inside perimeter, and if overtorqued, will crack the structural side cover,

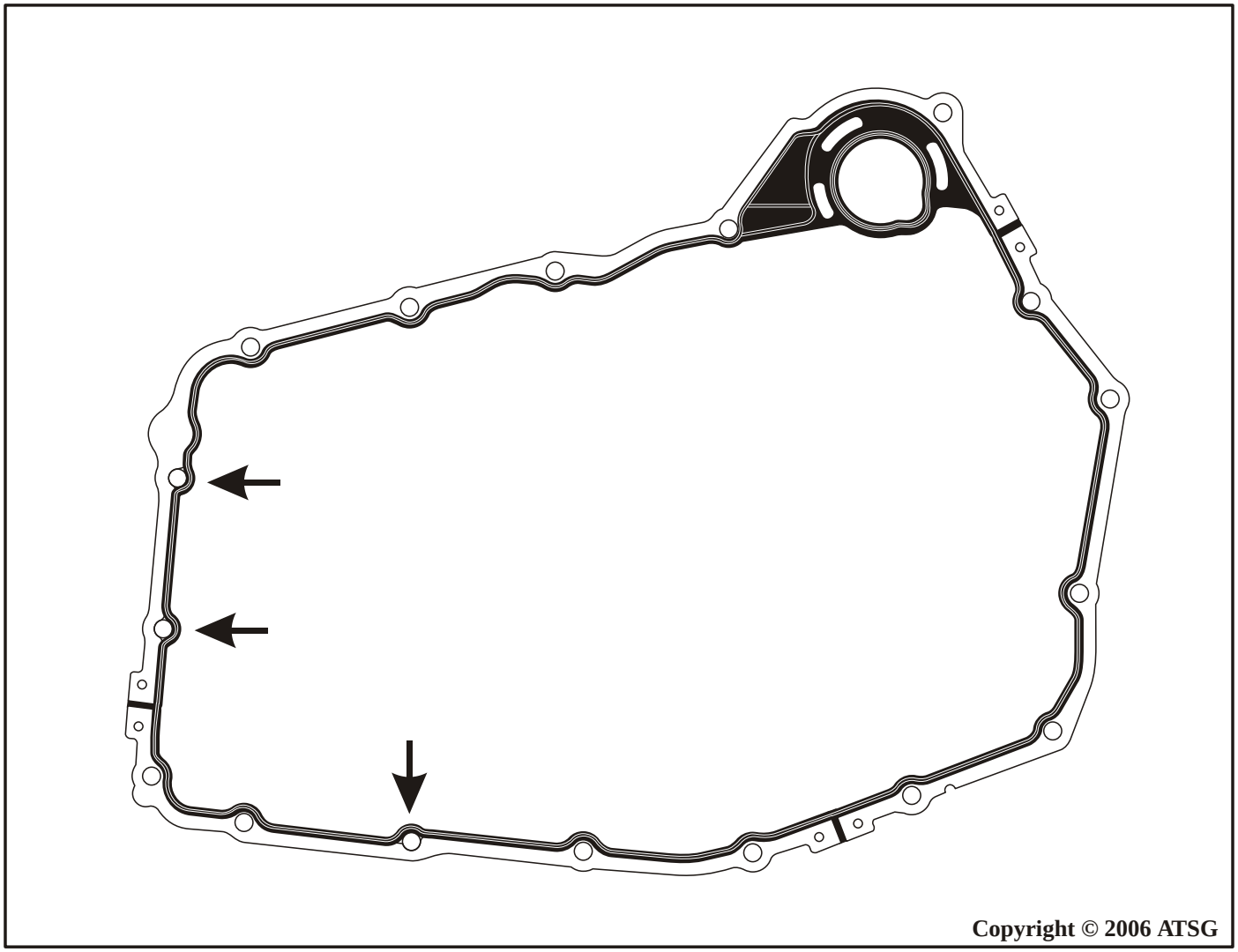


Figure 69

THM 4T65-E

CHANNEL PLATE AND COOLER FITTING CHANGES

CHANGE: Beginning on January 19, 2004, all 4T65-E transaxles were built with the drainback ball removed from the return cooler line fitting, and relocated in the channel plate next to the torque converter blow-off ball and spring. Refer to Figure 71.

REASON: In an effort to prevent debris from gathering in return line fitting, to help prevent torque converter drainback. Also a cost savings.

PARTS AFFECTED:

(1) CHANNEL PLATE - Drainback ball, spring, and retainer added to the channel plate next to the torque converter blow-off ball and spring. Channel Plates built "Before" January 19, 2004 are shown in Figure 70, and the Channel Plates built "After" January 19, 2004 are shown in Figure 71.

(2) RETURN COOLER FITTING - The January 19, 2004 and later cooler line case fittings both have the same threads, which is 9/16-18 UNF, and the return line cooler case fitting does not contain a ball and spring. Refer to Figure 72.
The prior to January 19, 2004 cooler line case fittings have different threads. The supply cooler line case fitting has a 1/4-18 NPSF thread. The return line cooler case fitting has a 3/8-18 NPSF thread, and contains the drainback ball and spring. Refer to Figure 72.

INTERCHANGEABILITY:

These Channel Plates are not interchangeable, but could be done by mistake.

(1) If a prior to January 19, 2004 Channel Plate, without the drainback ball and spring, is installed on a transaxle built after January 19, 2004, the result will be severe converter drainback.

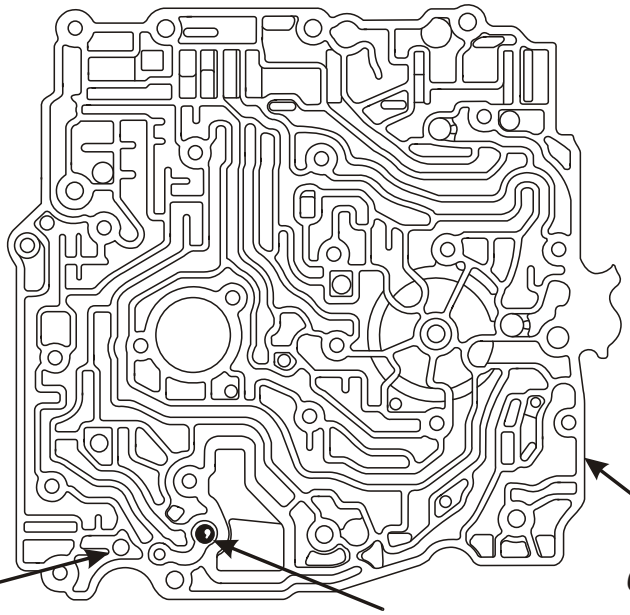
(2) If a January 19, 2004 and later Channel Plate is installed on a transaxle built before January 19, 2004, the result will be 2 drainback balls in the circuit, and severe restriction of lube oil.

(3) If a prior to January 19, 2004 Channel Plate, without the drainback ball and spring, is installed on a transaxle built after January 19, 2004, with the intention of installing the return line cooler case fitting with the drainback ball, this can not be accomplished as the thread sizes are different between case and fitting. Refer to Figure 72.

Special Note:

When Channel Plate replacement is required, make certain that the "Drainback/Cooler Blow-Off ball and spring is present, and in the proper location for the model year transaxle you are rebuilding.

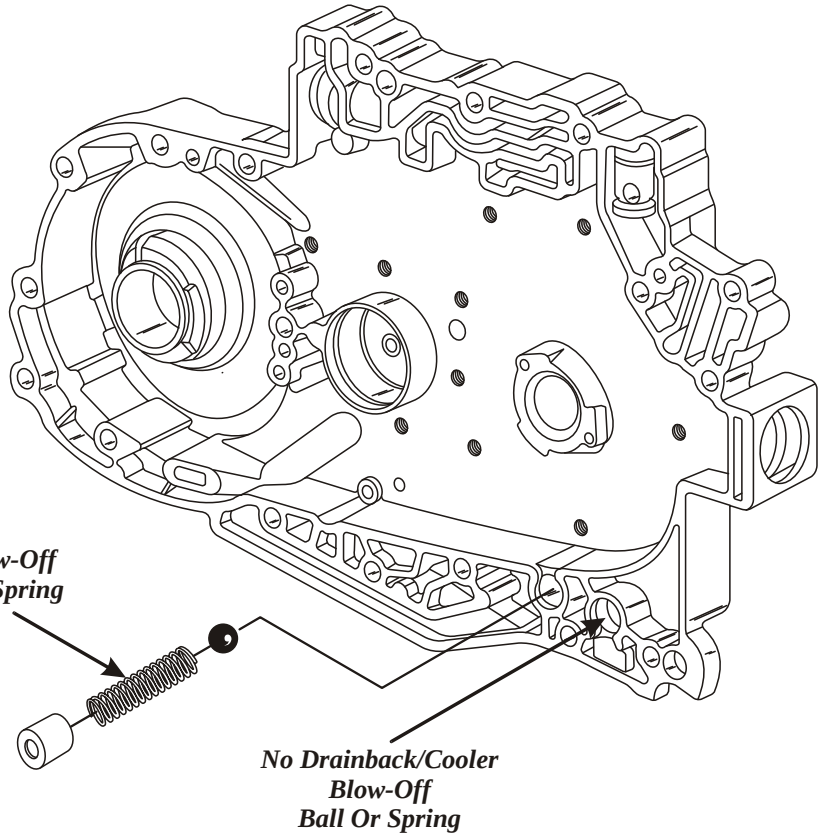
4T65-E TRANSAXLES BUILT "BEFORE" 1/19/04



Channel Plate (Valve Body Side)

No Drainback/Cooler Blow-Off Ball And Spring Visable Through Hole In Channel Plate

TCC Blow-Off Ball And Spring

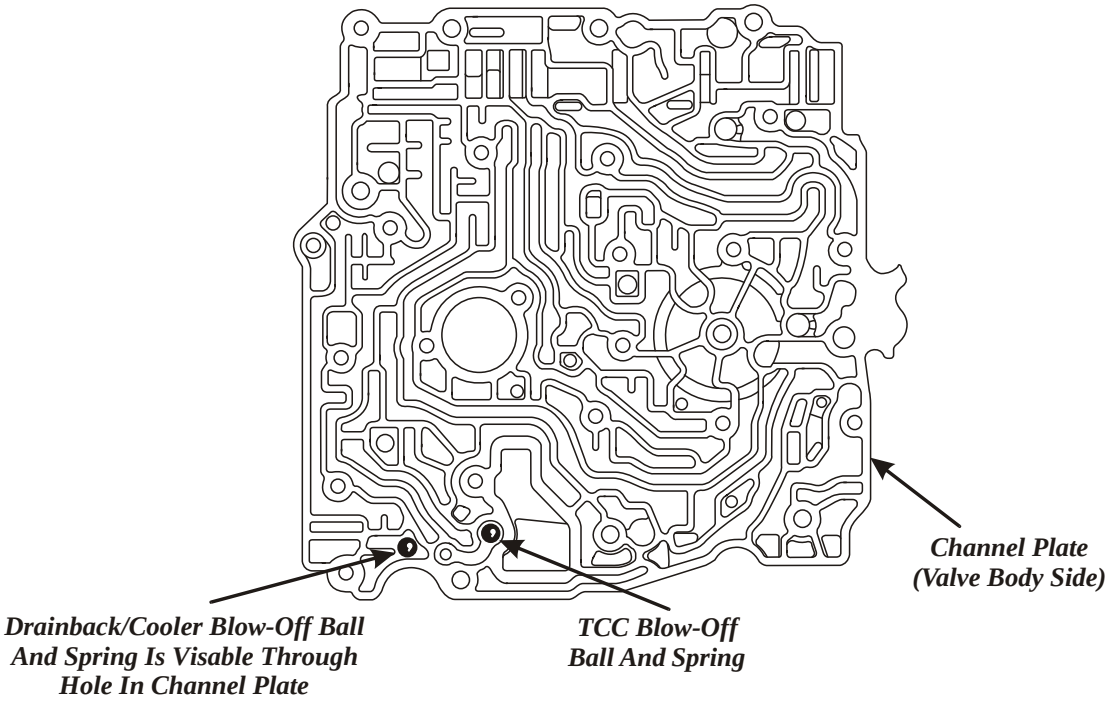


TCC Blow-Off Ball And Spring

No Drainback/Cooler Blow-Off Ball Or Spring

Figure 70

4T65-E TRANSAXLES BUILT "AFTER" 1/19/04



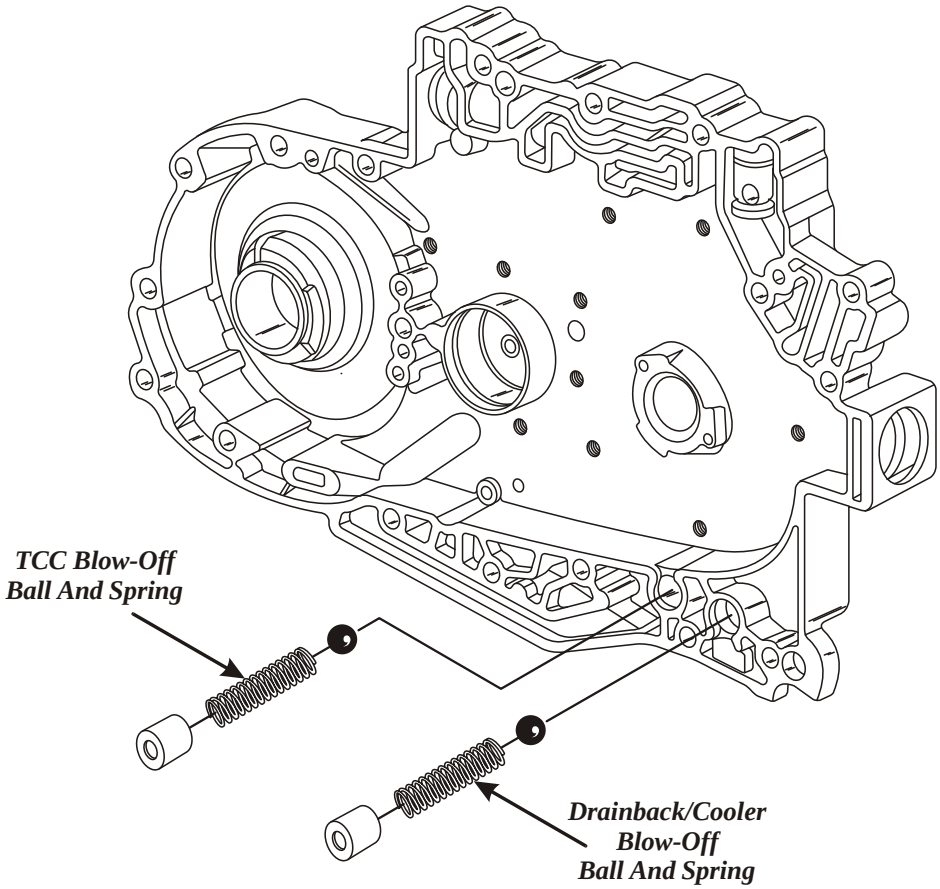


Figure 71

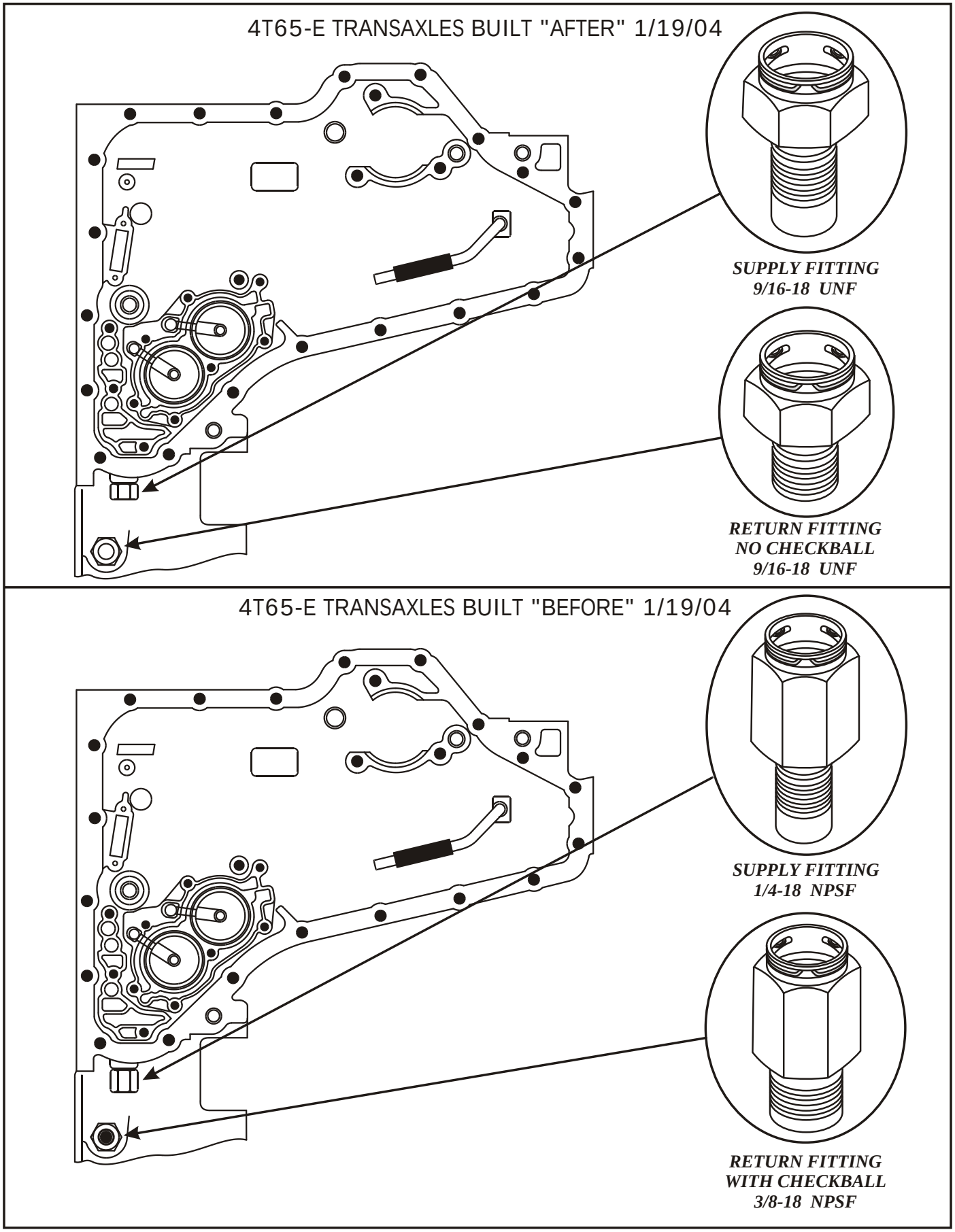

4T65-E TRANSAXLES BUILT "AFTER" 1/19/04
SUPPLY FITTING
9/16-18 UNF
RETURN FITTING
NO CHECKBALL
9/16-18 UNF
4T65-E TRANSAXLES BUILT "BEFORE" 1/19/04
SUPPLY FITTING
1/4-18 NPSF
RETURN FITTING
WITH CHECKBALL
3/8-18 NPSF

Figure 72

THE REMAINDER OF THIS MANUAL IS DEVOTED TO THE DIFFERENCES IN THE VOLVO VERSION AND THE GM VERSION OF THE 4T65-E TRANSAXLE

THM 4T65-E/EV-GT
PRELIMINARY INFORMATION

GENERAL DESCRIPTION

The General Description and the Planetary Gearset Description is exactly the same as the General Motors version, and is described on Page 3.

Volvo's designation on this unit is 4T65-E/EV-GT, is found in 1999-2005 80 Series with the 2.8L or the 3.0L engine, and is illustrated in Figute 73.

Changing gear ratios is fully automatic and is accomplished through the use of a Transmission Control Module ***(TCM in the Volvo)***, where the General Motors version uses a Powertrain Control Module (PCM).

The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transaxle at the optimum time.

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

A Component Application chart and a solenoid application chart have been provided for you in Figure 74.

Volvo Designation 4T65-E/EV-GT
1999-2005 80 Series 2.8L Or 3.0L Engine

Transmission Fluid: Dexron III with G-license number (G-32xxx).

Weight including fluid: 97.0 kg (214 lbs)

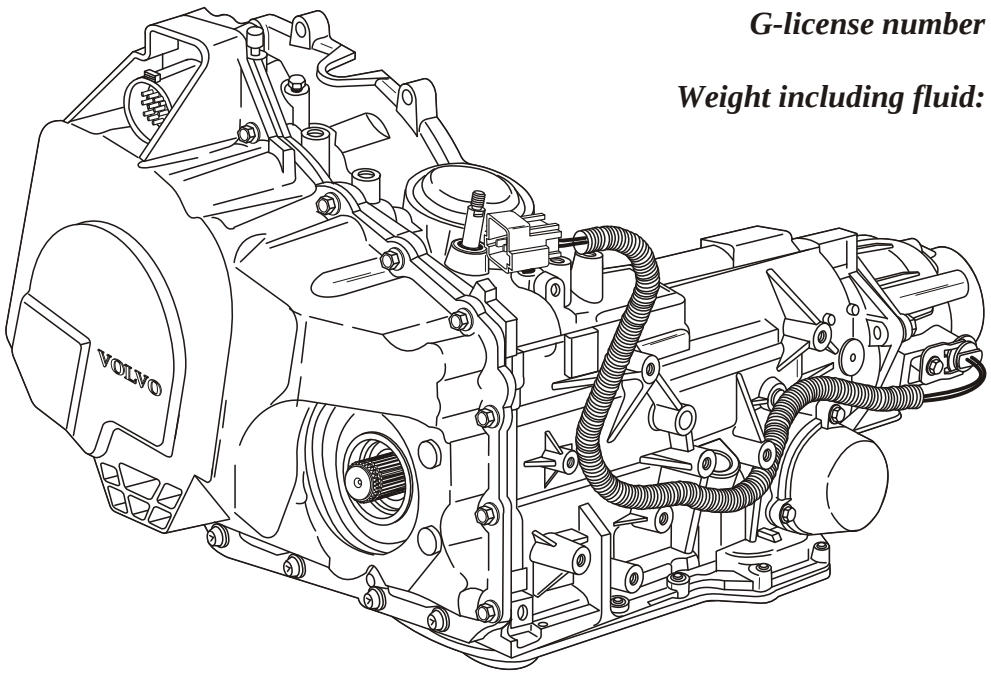
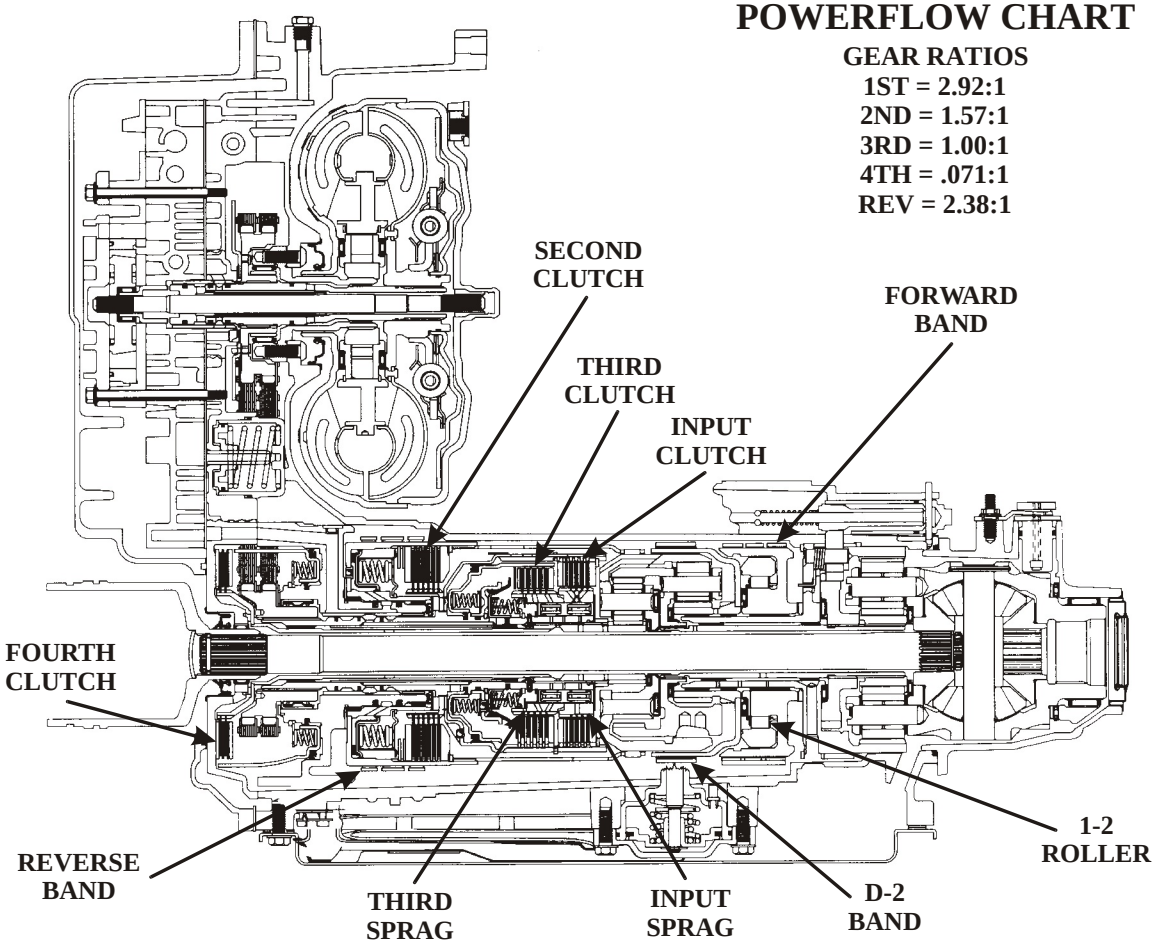


Figure 73

POWERFLOW CHART

GEAR RATIOS
1ST = 2.92:1
2ND = 1.57:1
3RD = 1.00:1
4TH = .071:1
REV = 2.38:1



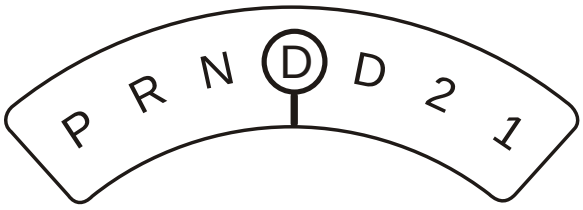
RANGE	1-2/3-4 Solenoid	2-3 Solenoid	Input Clutch	Second Clutch	Third Clutch	Fourth Clutch	Forward Band	D-2 Band	Reverse Band	Input Sprag	1-2 Roller	Third Sprag
PARK	ON	ON	ON*							ON*		
REVERSE	ON	ON	ON						ON	HOLD		
NEUTRAL	ON	ON	ON*							ON*		
"O/D"- 1ST	ON	ON	ON				ON			HOLD	HOLD	
"O/D"- 2ND	OFF	ON	ON*	ON			ON			F/W	HOLD	
"O/D"- 3RD	OFF	OFF		ON	ON		ON			F/W	F/W	HOLD
"O/D"- 4TH	ON	OFF		ON	ON	ON	ON			F/W	F/W	F/W
"D"- 3RD	OFF	OFF	ON	ON	ON		ON			HOLD	F/W	HOLD
"D"- 2ND	OFF	ON	ON*	ON			ON			F/W	HOLD	
"D"- 1ST	ON	ON	ON				ON			HOLD	HOLD	
"2"- 2ND	OFF	ON	ON*	ON			ON	ON		F/W	HOLD	
"2"- 1ST	ON	ON	ON				ON	ON		HOLD	HOLD	
"1"- 1ST	ON	ON	ON		ON		ON	ON		HOLD	HOLD	HOLD

*** APPLIED BUT NOT EFFECTIVE**

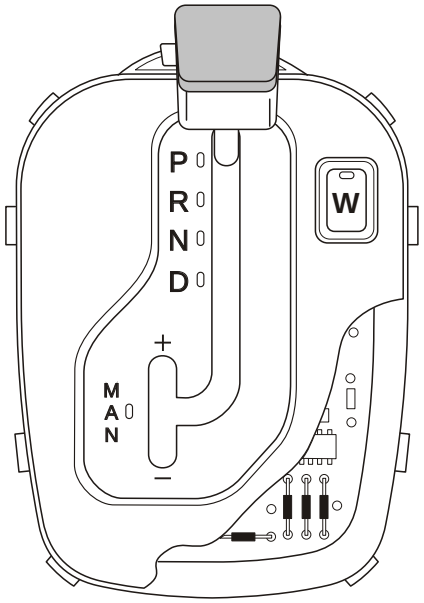
The Geartronic version uses only these forward gears, plus Park, Neutral and Reverse

Figure 74

SHIFT QUADRANT ASSEMBLIES



Conventional PRNDL Indicator

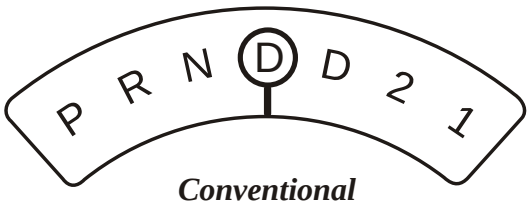


Volvo = "Tiptronic"
GM = "Geartronic"

Figure 75

SHIFT QUADRANT ASSEMBLIES

The 4T65-E transaxle is available with Geartronic (GM) or Tiptronic (Volvo), both of which are a manual shift strategy package. The 4T65-E transaxle is also available with GM's typical 7 position gear select of PRND321, and both are illustrated in Figure 75. It is when a Geartronic/Tiptronic shift package is used that there are significantly more differences between GM and Volvo applications. Both packages will be explained in detail, beginning with the conventional 7 position gear selector on the following page.



Conventional PRNDL Indicator

Figure 76

GEAR RANGE DESCRIPTION

Conventional Shift Quadrant

The transaxle can be operated in any one of the seven different positions on the conventional shift quadrant, that is shown in Figure 76.

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

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

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

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

D - Manual third can be used for conditions where it may be desirable to use only three gear ratios. These conditions include towing a trailer or driving on hilly terrain. This range is also helpful for engine braking when decending slight grades. Upshifts and downshifts are the same as Overdrive range first, second and third gears, but the transaxle will not upshift to fourth gear.

2 - Manual second adds more performance for congested traffic and hilly terrain. It has the same starting ratio (1st gear) as in Manual third, but prevents the transaxle from shifting above second. Thus manual second can be used to retain second gear for accelerations and engine braking as desired. Manual second can be selected at any vehicle speed but will not downshift into 2nd gear until the vehicle speed drops below approximately 100 Km/h (62 mph).

1 - Manual first can be selected at any vehicle speed. If the transaxle is in third or fourth gear it will immediately shift into second gear. When the vehicle speed slows to below approximately 60 Km/h (37 mph) the transaxle will then shift into first gear. This is particularly beneficial for maintaining maximum engine braking when descending steep grades.

GEAR RANGE DESCRIPTION

Geartronic/Tiptronic Shift Quadrant

As an alternative to the conventional automatic transaxle, this transmission is also available with "Tiptronic" (Volvo) or "Geartronic" - GM) , which is a manual shifting feature.

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

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

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

D - This is Overdrive range and should be used for all normal driving conditions for maximum efficiency and fuel economy. Overdrive range allows the transaxle to operate in each of the four forward gear ratios. Downshifts to a lower gear, from a higher gear ratio are available for safe passing, by depressing the accelerator pedal, or by manually selecting a lower gear range with the selector lever, placed in the "MAN" position.
(See Figure 77).

When the gear selector is moved to the "MAN" position, the automatic tranaxle remains in hydraulic position D, but when the gear selector is moved upwards towards (+) the gear selector module (GSM) transmits a signal to the transmission control module (TCM) to shift up. When the gear selector is moved downwards towards the (-) a signal is transmitted to the transmission control module (TCM) to shift down. The driver information module (DIM) switches the symbol in the combined instrument panel from D to the current gear, for example 3, when the gear selector is in the MAN position and 3rd gear has been requested.

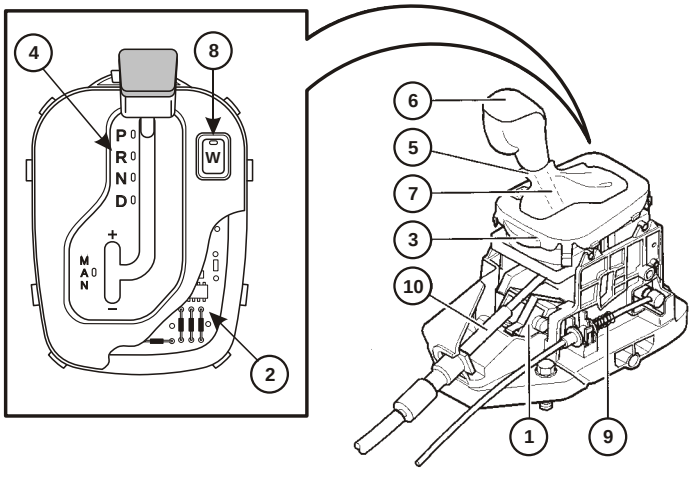
When the MAN position is selected, a signal is sent to the gear selector module (GSM) to light the MAN LED and switches off the other LEDs. The transmission control module (TCM) determines if shifting can be carried out, and the driver information module (DIM) indicates the current gear. If shifting is permitted, the solenoids are activated according to each specific gear pattern.

However, in certain situations, the transmission control module (TCM) will override the drivers manual shifting decisions and assume the shifting decisions itself, and then the following applies:

(1) When the vehicle is stationary, only 1st, 2nd and 3rd gears can be manually selected. 4th gear can be selected only at speeds exceeding 30 km/h.

(2) Down shifting occurs for all gears, only below a pre-calibrated speed, to prevent engine over speed.

Continued on next Page



1 Shiftlock Solenoid.
2 Printed Circuit Board - This is the Gear Selector Module (GSM).
3 Shift Quadrant Top Panel.
4 Gear Shift Position Indicator and LED's.
5 Shift Quadrant Dust Boot
6 Gear Selector Lever Handle
7 Shift Lever Push Rod
8 Winter Button
9 Ignition Switch Interlock Cable
10 Transmission Shift Cable

Figure 77

GEAR RANGE DESCRIPTION (CONT"D)

Geartronic/Tiptronic Shift Quadrant (Cont'd)

(3) Automatic down shifting occurs when shifting from 2nd gear to 1st at 2 km/h, if the speed before this request has exceeded 25 km/h. In other cases 2nd gear is retained. For example, when 3rd gear is requested despite the car being stationary.

(4) Manual up shifting is required after automatic down shifting. Kick-down is not available in the Geartronic position (MAN).

(5) The permitted speed for manual down shifting corresponds to those for kickdown up shifting, i.e. engine speed at approximately 6,000 rpm.

(6) If the transmission temperature becomes too high, the transmission control module (TCM) determines the shift position. The purpose is to maintain a gear where lock-up is possible at the current speed, for additional cooling.

(8) Lock-up is possible in 3rd and 4th gears only. (1st and 2nd gears do not have lock-up).

Other "MAN" Position Characteristics

In the MAN position a signal about the shift lever position is generated from the Gear Selector Module (GSM) as follows:

For each of the three gear selector positions a hall sensor is mounted on the printed circuit board for the gear selector control module (GSM). A permanent magnet on the lever affects the output signals from the sensors to the control module. The control module can read off the position of the lever through the differences in the signal characteristics.

In the 4T65EV/EV-GT (Volvo) the solenoid in the gear selector assembly also has a reverse inhibit function. The reverse inhibitor makes it impossible to engage R and P when the car is traveling faster than 12 km/h. The gear selector assembly, and therefore the solenoid, is supplied with current and signals via the connector on the rear side.

GEAR SELECTOR MODULE

There is a printed circuit board (2) located under the top panel (3) as shown in Figure 77. The circuit board has the "WINTER" button (8) and 14 LEDs (13 LEDs with Geartronic) which light up the gear position (4). The LEDs also indicate the selected gear. The gear selector assembly, solenoid and printed circuit board together, constitute the Gear Selector Module (GSM) and it is a slave module to the TCM. Refer to Figure 77.

Information between the Gear Selector Module and the Transmission Control Module (TCM), is transferred using serial communication, which requires a micro processor located on the printed circuit board.

The TCM gives instructions to the GSM about which LEDs should be lit up and to what strength of illumination. In addition, the TCM controls the solenoid connection at the reverse inhibitor.

The gear selector module informs the TCM about the position of the WINTER button and controls the connection of the solenoid for the reverse inhibitor function. In Geartronic/Tiptronic, information is sent about the gear shift lever position in MAN and if the gear selector lever is moved backwards or forwards.

The gear selector module is also connected to the transmission diagnostic system.

The TCM has built-in diagnostics which are read via the Data Link Connector (DLC) using a soft-ware program called VADIS, which is currently only available from Volvo.

SHIFTING PROGRAMS

Economy Mode

When driving under normal acceleration, the Transmission Control Module (TCM) uses a pre-set shifting program, optimized to shift for economy driving. This shifting program is suitable for “normal” driving which provides earlier up shifts and lock-up. In addition the transmission oil pressure is constantly adjusted to provide smooth gear engagements.

Continued on next Page

SHIFTING PROGRAMS (CONT"D)

Sport Mode

In the Sport Mode shifting program, the shifting points are adjusted to provide the best possible performance. Downshifts will occur earlier. The Transmission Control Module (TCM) selects the shifting and lock-up points which provide the best possible performance. The transmission switches from economy mode to sport mode if the accelerator pedal (AP) is pressed down quickly. The conditions are that the throttle opens quickly and the vehicle speed exceeds 50 km/h. As soon as the accelerator pedal (AP) is released to a certain level, economy mode is resumed. ***It is not equipped with any "Sport Mode" switch.***

Kickdown Mode

At wide open throttle (WOT) the kick-down function is implemented which provides quick downshifts for maximum performance. In this way a boost of power is achieved for passing.

Winter Mode

Winter mode is selected using the (W) button on the top panel of the gear selector assembly. Winter mode enables starting off in a higher gear to prevent the wheels from spinning on a slippery surface. This mode can also be used in other difficult situations in which the driver needs more direct control over gear selection. Lock-up can be engaged in 2nd gear. The shift pattern is optimized to minimize the number of shifts. Depending on the gear position, the following combinations can be obtained:

D - The car starts in 2nd gear. Automatic shifting between 2nd and 3rd gears occurs earlier than in Economy Mode, D position.

3 - The car starts in 2nd gear. 4th is locked out.

2 - The car starts in 2nd gear. There is no up shifting or downshifting.

1 - The car starts in 1st gear. There is no up shifting or downshifting.

The "W" lamp on the dashboard lights when winter mode is selected.

If kick-down is activated in Winter mode, the transmission uses all gears for maximum performance.

EMERGENCY MODES

An emergency program is activated to deal with a fault when the transmission control module (TCM) detects a transmission permanent fault. The control system then implements corrective action to protect the transmission, while leaving the car in the best possible drive-able condition. Minor faults do not activate an emergency program. There are several emergency programs, depending on the type of fault detected. Emergency Mode I, Emergency Mode II, Emergency Mode III, or Limp-home Mode.

Emergency mode I is activated in the event of minor faults and the Limp-home mode is activated for only the most serious faults. If the malfunction is intermittent, the transmission control module (TCM) returns to normal operation the next time the ignition switch is cycled.

Emergency Mode I

(1) The warning lamp in the combined instrument panel illuminates, if a certain diagnostic trouble code (DTC) is stored.

(2) The transmission shifts in all gears but transmits no signal to the lock-up solenoid. This means that lockup is not available.

Emergency Mode II

(1) The warning lamp in the combined instrument panel illuminates if a certain diagnostic trouble code (DTC) is stored.

(2) The transmission shifts in all gears but transmits no signal to the lock-up solenoid. This means that lockup is not available.

(3) No reduction of line pressure when moving the gear selector between positions P-R, N-R and N-D. This results in harsh shifting.

(4) No torque limiting request from the engine control module (ECM) during gear shifting.

Continued on next Page

Emergency Mode III

(1) The warning lamp in the combined instrument panel illuminates, if a certain diagnostic trouble code (DTC) is stored.

(2) The transmission shifts in all gears but transmits no signal to the lock-up solenoid. This means that lockup is not available.

(3) No reduction of line pressure when moving the gear selector between positions P-R, N-R and N-D. This results in harsh shifting.

(4) No torque limiting request from the engine control module (ECM) during gear shifting.

(5) No control of Line Pressure Solenoid (STH). Constant maximum system pressure. This results in harsh shifting and harsher gear engagement in positions P-R, N-R and N-D.

Limp-Home Mode

(1) The transmission control module (TCM) interrupts the activation of all solenoids. This results in the transmission not shifting at all. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd and 4th gear and reverse gear.

(2) No control of Line Pressure Solenoid (STH). Constant maximum system pressure. This results in harsh shifting and harsher gear engagement in positions P-R, N-R and N-D.

(3) The warning lamp in the combined instrument panel flashes indicating DTC stored.

(4) ***Note! When starting and driving, the gear selector should first be moved to position L to minimize stress on the transmission.***

RETRIEVING DIAGNOSTIC TROUBLE CODES

Currently, the only thing to retrieve a DTC from the TCM on the Volvo, is a software package called VADIS, to be loaded on a lap-top computer and is available only from Volvo. VADIS stands for "Volvo Aftersales Diagnostic Information System".
A text message will be displayed in the combined instrument panel for Diagnostic Trouble Codes (DTCs) that are stored in the Transmission Control Module (TCM).

Diagnostic Trouble Codes (DTC's) for Volvo, along with their descriptions, are found on Pages 92 and 93 in this Manual.

FLUID REQUIREMENTS

Transmission Fluid used must be; Dexron III with G-license number (G-32xxx).

Capacities

(1) Routine service with bottom pan removed: 7.0L (7.4 US Quarts). (Approximate)

(2) If bottom pan and torque converter removed: 9.5L (10 US Quarts). (Approximate)

(3) Completely dry including cooling circuit: 12.4L (13 US Quarts). (Approximate)

Fluid Change Features

A counter for transmission oil quality is built into the software for the transmission control module (TCM). The TCM monitors the amount of time the oil is above a certain temperature. When the counter has reached the maximum value, the diagnostic trouble code (DTC) for an oil change is stored in the control module. When replacing transmission fluid, the counter must be reset to prevent a diagnostic trouble code (DTC) being stored incorrectly. This applies when the transmission fluid is changed and when the fluid is changed during a repair.
The reset function is activated only via VADIS through the vehicle communication connector.

"VOLVO" DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION	
VOLVO DTC	DESCRIPTION
TCM-0001	**Shift Solenoid S1, Signal Too High**
TCM-0002	**Shift Solenoid S1, Signal Missing**
TCM-0003	**Shift Solenoid S1, Signal Too Low**
TCM-0007	**Shift Solenoid S2, Signal Too High**
TCM-0008	**Shift Solenoid S2, Signal Missing**
TCM-0009	**Shift Solenoid S2, Signal Too Low**
TCM-000B	**Shift Solenoid S1, Hydraulic Fault**
TCM-000C	**Shift Solenoid S2, Hydraulic Fault**
TCM-000D	**Line Pressure Solenoid STH, Signal Too High, Intermittent Or Permanent Fault**
TCM-000F	**Line Pressure Solenoid STH, Signal Missing, Intermittent Fault**
TCM-0010	**Line Pressure Solenoid STH, Signal Too Low, Intermittent Or Permanent Fault**
TCM-0012	**Lock-up Solenoid SL, Signal Too High, Intermittent Fault**
TCM-0013	**Lock-up Solenoid SL, Signal Missing, Intermittent Or Permanent Fault**
TCM-0014	**Lock-up Solenoid SL, Signal Too Low, Intermittent Or Permanent Fault**
TCM-0015	**Lock-up Solenoid SL, Hydraulic Fault**
TCM-0016	**TCM, Internal Fault, Intermittent Or Permanent Fault**
TCM-001F	**Vehicle Speed Sensor, Signal Missing, Intermittent Or Permanent Fault**
TCM-0020	**Vehicle Speed Sensor, Faulty Signal, Intermittent Or Permanent Fault**
TCM-0023	**Input Speed Sensor, Signal Missing, Intermittent Or Permanent Fault**
TCM-0024	**Input Speed Sensor, Faulty Signal, Intermittent Or Permanent Fault**
TCM-0027	**Reverse Gear Ratio Error**
TCM-0028	**First Gear Ratio Error**
TCM-0029	**Second Gear Ratio Error**
TCM-002A	**Third Gear Ratio Error**
TCM-002B	**Fourth Gear Ratio Error**
TCM-002F	**Lock-up Function, Slipping Or Not Applied**
TCM-0039	**Internal Mode Switch, Faulty Signal**
TCM-0042	**Oil Temperature Too High**
TCM-0043	**Transmission Fluid Temperature Sensor, Signal Too Low**
TCM-0044	**Transmission Fluid Temperature Sensor, Signal Too High**
TCM-0045	**Transmission Fluid Temperature Sensor, Faulty Signal**
TCM-0046	**Oil Temperature Too High**
TCM-0048	**TCM, Faulty Software**

Figure 78

"VOLVO" DIAGNOSTIC TROUBLE CODE (DTC) IDENTIFICATION	
VOLVO DTC	DESCRIPTION
TCM-0049	**TCM, Internal Fault, Intermittent Fault or Permanent Fault**
TCM-0050	**Lock-up Solenoid SL, Stuck**
TCM-0051	**Lock-up Solenoid SL, Stuck**
TCM-0052	**Lock-up Solenoid SL, Stuck**
TCM-0053	**Lock-up Pressure Switch, Stuck**
TCM-0054	**Lock-up Pressure Switch, Stuck**
TCM-0060	**TCM, Internal Fault**
TCM-0061	**TCM, Internal Fault**
TCM-0062	**TCM, Internal Fault**
TCM-0081	**Vehicle Speed Sensor, Signal Too High**
TCM-0083	**Vehicle Speed Sensor, Signal Too Low**
TCM-0087	**Vehicle Speed Sensor, Signal Too High**
TCM-0089	**Vehicle Speed Sensor, Signal Too Low**
TCM-008D	**Lock-up Pressure Switch, Faulty Signal**
TCM-0090	**Shift Lock Solenoid, Signal Too High**
TCM-0091	**Shift Lock Solenoid, Signal Missing**
TCM-0092	**Shift Lock Solenoid, Signal Too Low**
TCM-0093	**TCM Communication, Gear Selector Lever, Signal Too High**
TCM-0094	**TCM Communication, Gear Selector Lever, Signal Missing**
TCM-0095	**TCM Communication, Gear Selector Lever, Signal Too Low**
TCM-0096	**Quickshift Sensor, Faulty Signal**
TCM-0099	**TCM, Internal Fault**
TCM-009A	**Battery Voltage, Signal Low**
TCM-0350	**Wrong Transaxle**
TCM-E000	**TCM Communication, Faulty Communication**
TCM-XXXX	**Unknown DTC For The Current TCM**

Figure 79

GM AND VOLVO DIFFERENCES

As previously stated, this transmission is available with Tiptronic/Geartronic, a manual shift strategy package. This means it is also available with GM's typical 7 position gear select of PRND321. It is when a Tiptronic/Geartronic shift package is used, that there are ***significantly*** more differences between GM and Volvo applications. Following are most of the changes to be aware of, some of which are obvious, but we will mention them anyway.

EXTERNAL DIFFERENCES

Transaxle Case

Obviously, the bell housing bolt pattern is different but there are also major differences in the boss' on the side of the case, as shown in Figure 80.

Extension Housing

The extension housing is also unique to the Volvo, as the output speed sensor bolts in at a different angle, and is also much longer to accommodate a longer final drive housing, than the GM version (See Figure 80). Refer to Page 110 and 112 for the details on the final drive and the extension housing changes.

Output Speed Sensor

The output speed sensor is also unique to the Volvo, as the wire harness is connected to the sensor, as shown in Figure 80.

Internal Wire Harness

The TCM does not use all of the signals from the pressure switch assembly on vehicles with the Tiptronic/Geartronic package. This system uses only the TCC switch, however, the internal wiring harness is the same. It is the external wiring harness which plugs into the transmission that eliminates the wiring for the switches not being used. An internal wire schematic has been provided for you in Figure 81, and case connector pin identification has been provided in Figure 82.

Continued on Page 97

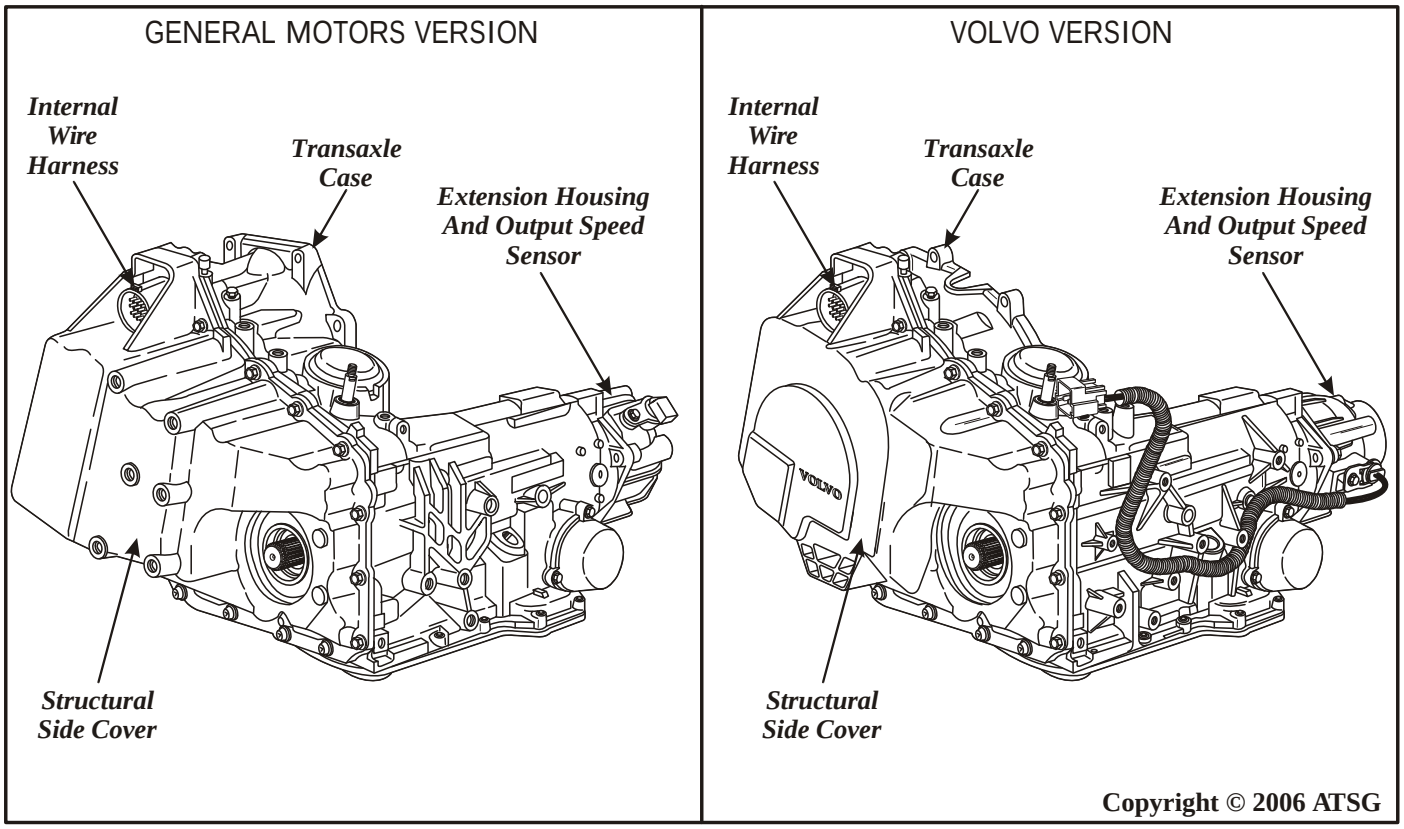


Figure 80

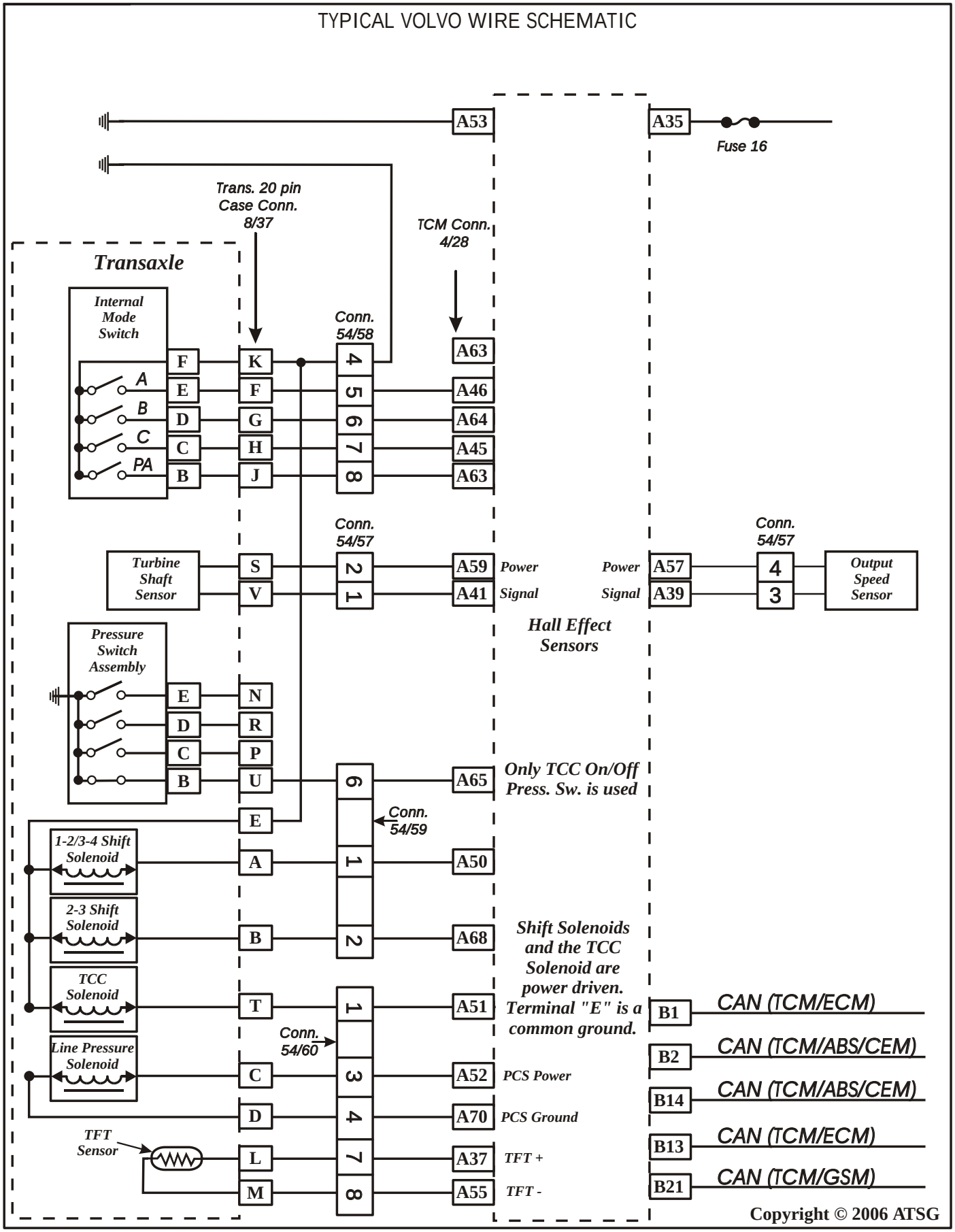
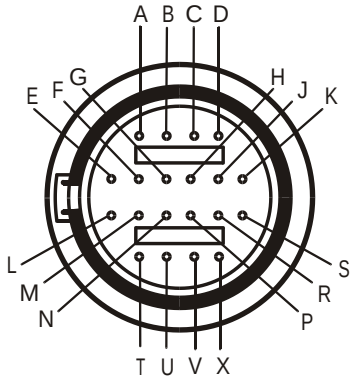

TYPICAL VOLVO WIRE SCHEMATIC
Transaxle
Trans. 20 pin Case Conn. 8/37
TCM Conn. 4/28
Internal Mode Switch
A
B
C
PA
F
E
D
C
B
K
F
G
H
J
Conn. 54/58
4
5
6
7
8
A63
A46
A64
A45
A63
A53
A35
Fuse 16
Turbine Shaft Sensor
S
V
Conn. 54/57
2
1
A59
A41
Power
Signal
Hall Effect Sensors
Power
Signal
A57
A39
Conn. 54/57
4
3
Output Speed Sensor
Pressure Switch Assembly
E
D
C
B
N
R
P
U
E
6
A65
Only TCC On/Off Press. Sw. is used
Conn. 54/59
1-2/3-4 Shift Solenoid
A
1
A50
2-3 Shift Solenoid
B
2
A68
TCC Solenoid
T
1
A51
Shift Solenoids and the TCC Solenoid are power driven. Terminal "E" is a common ground.
Conn. 54/60
Line Pressure Solenoid
C
3
A52
PCS Power
D
4
A70
PCS Ground
TFT Sensor
L
7
A37
TFT +
M
8
A55
TFT -
B1
CAN (TCM/ECM)
B2
CAN (TCM/ABS/CEM)
B14
CAN (TCM/ABS/CEM)
B13
CAN (TCM/ECM)
B21
CAN (TCM/GSM)
Copyright © 2006 ATSG

Figure 81

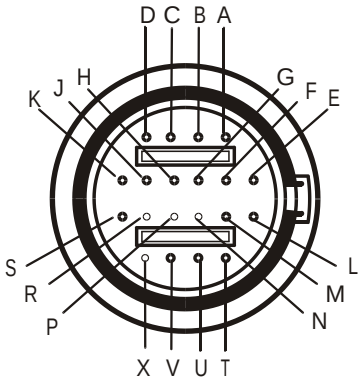
VOLVO CASE CONNECTOR TERMINAL IDENTIFICATION



View Looking Into
Transaxle Case Connector

Ohms Resistance Chart			
Cavities	Component	Resistance @ 68°F	Resistance @ 190°F
A-E	1-2 Shift Solenoid	19-24W	24-31W
B-E	2-3 Shift Solenoid	19-24W	24-31W
T-E	TCC/PWM Solenoid	10-12W	13-15W
C-D	EPC Solenoid	3-5W	5-6W
S-V	Input Speed Sensor	Hall Effect	Hall Effect
M-L	TFT Sensor	3164-3867W	225-285W
	Output Speed Sensor	Hall Effect	Hall Effect

A - Shift Solenoid 1 Power Signal Wire
B - Shift Solenoid 2 Power Signal Wire
C - Pressure Control Solenoid Power Signal Wire
D - Pressure Control Solenoid Ground Wire
E - Ground for Shift Solenoids and Lock-up Solenoid
F - Internal Mode Switch Signal "A"
G - Internal Mode Switch Signal "B"
H - Internal Mode Switch Signal "C"
J - Internal Mode Switch Signal "P"
K - IMS Ground (Shared with terminal "E")
L - TFT Sensor Signal Wire
M - TFT Sensor Ground Wire
N - Pressure Switch Assembly PS1 Signal
P - Pressure Switch Assembly PS3 Signal
R - Pressure Switch Assembly PS2 Signal
S - Turbine Shaft Speed Sensor Power
T - Lock-up Solenoid Power Signal Wire
U - Pressure Switch Assembly PS4 Signal
V - Turbine Shaft Speed Sensor Signal
X - Not Used



View Looking Into
Vehicle Harness Connector

A - Shift Solenoid 1 Power Signal Wire
B - Shift Solenoid 2 Power Signal Wire
C - Pressure Control Solenoid Power Signal Wire
D - Pressure Control Solenoid Ground Wire
E - Ground for Shift Solenoids and Lock-up Solenoid
F - Internal Mode Switch Signal "A"
G - Internal Mode Switch Signal "B"
H - Internal Mode Switch Signal "C"
J - Internal Mode Switch Signal "P"
K - IMS Ground (Shared with terminal "E")
L - TFT Sensor Signal Wire
M - TFT Sensor Ground Wire
N - Not Used
P - Not Used
R - Not Used
S - Turbine Shaft Speed Sensor Power
T - Lock-up Solenoid Power Signal Wire
U - Pressure Switch Assembly PS4 Signal
V - Turbine Shaft Speed Sensor Signal
X - Not Used

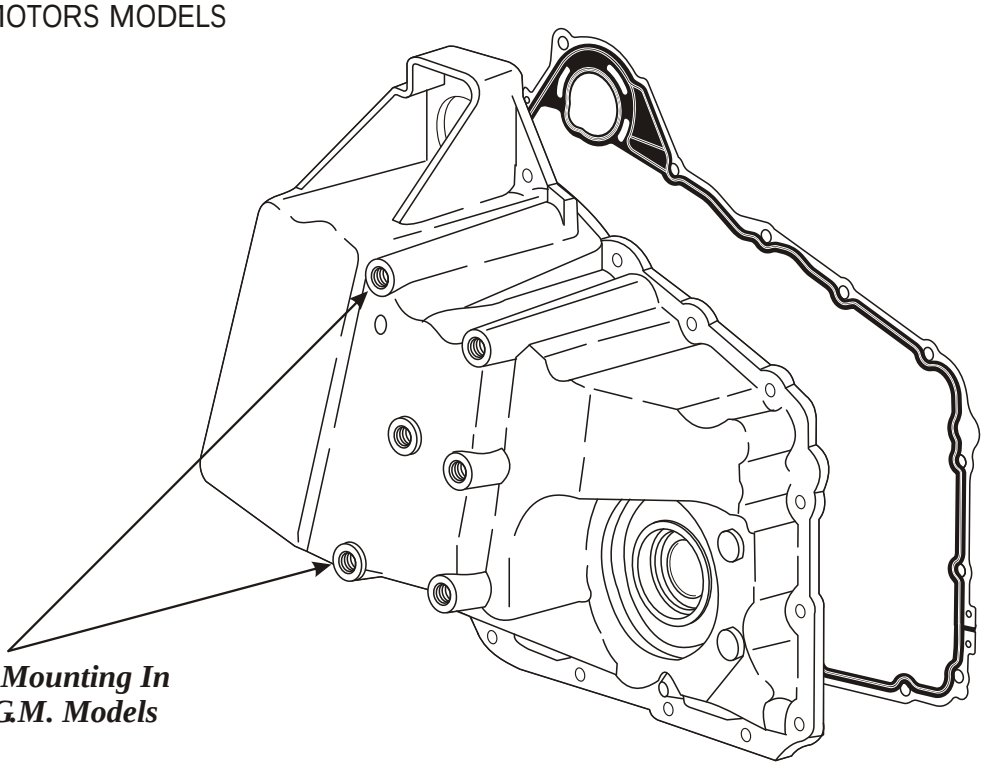
Figure 82

EXTERNAL DIFFERENCES

Structural Side Cover

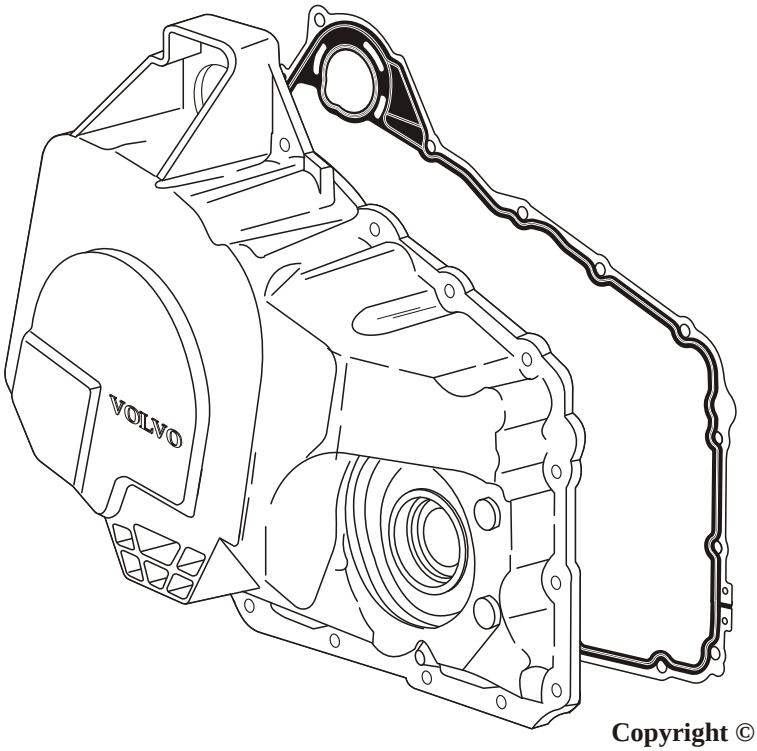
Notice that Volvo does not use the structural side cover for mounting purposes in the vehicle, as shown in Figure 83. Bolt pattern to the case is the same as well as the side cover gasket.

ALL GENERAL MOTORS MODELS



Used For Mounting In Various G.M. Models

ALL VOLVO MODELS



"Not Used" For Mounting Purposes

Figure 83

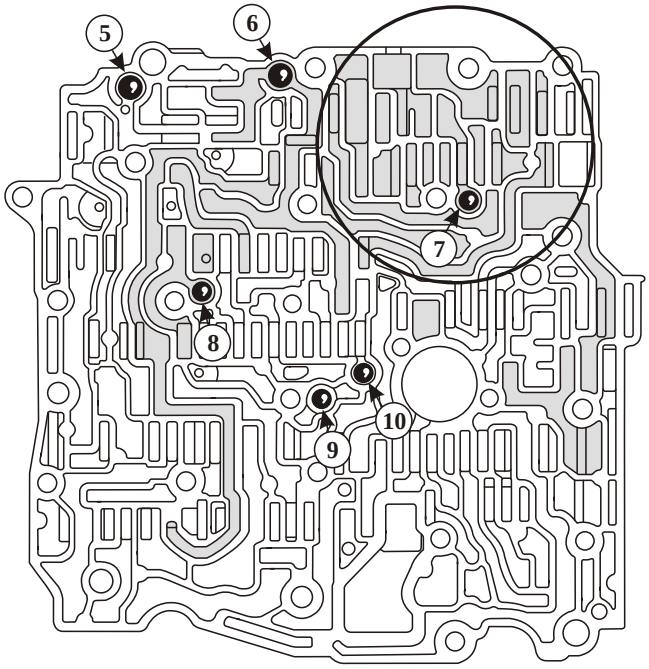
INTERNAL DIFFERENCES

Valve Body Assembly

G.M. and Volvo both use the "Geartronic/Tiptronic" shift strategy which allows for engine breaking in 1st, 2nd and 3rd gears manually. To accommodate this shift strategy, hydraulic changes were made to the valve body, in the worm track area. The changes in the worm track passages are highlighted, and the significant changes are shown inside of the circles in Figure 84. The major changes are in the manual valve area of the valve body.

The checkballs are in the same locations in both versions of the valve bodies, as shown in Figure 84, but the number 7 and the number 8 checkball functions are different between "Conventional" and the "Tiptronic" valve bodies. Refer to "Checkball Functions" on Page 99.

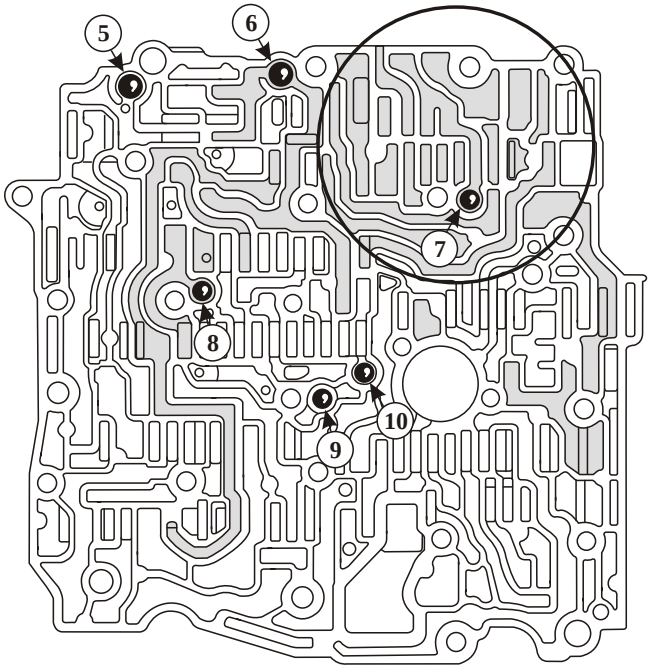
CONVENTIONAL PRNDL VERSION



Valve Body

Checkball locations are the same for both "Conventional" and "Tiptronic", but the No. 7 and No. 8 Checkball functions are different between the two. Refer to Checkball Functions onPage 99.

GEARTRONIC/TIPTRONIC VERSION



Valve Body

Checkball locations are the same for both "Conventional" and "Tiptronic", but the No. 7 and No. 8 Checkball functions are different between the two. Refer to Checkball Functions onPage 99.

Figure 84

INTERNAL DIFFERENCES (CONT'D)

Checkball Functions

CONVENTIONAL PRNDL VERSION	GEARTRONIC/TIPTRONIC VERSION
Number 7: LO/LO-1st Located in the valve body as shown in Figure 84, it blocks the lo-1st passage when Drive Range Manual First gear is selected, and sends Lo fluid pressure to the 1-2 shift valve where it passes through the valve and is forced through orifice 27 into the Lo-1st circuit. ***N umber 8: D2/Manual 2-1 Servo Feed*** Located in the valve body as shown in Figure 84, it is fed by D-2 fluid from the manual valve and seated against orificed manual 2-1 servo feed fluid at the spacer plate. D-2 fluid is then directed to the 3-2 Manual Downshift valve, where it enters the 2-1 manual servo feed passage and is forced through orifice 13. When the 2-1 manual band servo releases, the ball check valve unseats and fluid exhausts without going through orifice 13.	***Number 7: LO*** Located in the valve body as shown in Figure 84, it is part of the Lo fluid circuit but has no function as the fluid is blocked at the spacer plate. ***Number 8: D2/Manual 2-1 Servo Feed*** Located in the valve body as shown in Figure 84, it is fed by D-3 and D-2 fluid from the manual valve and seated against orificed manual 2-1 servo feed fluid at the spacer plate. D-2 or D3 fluid is then directed to the 3-2 Manual Downshift valve, where it enters the 2-1 manual servo feed passage and is forced through orifice 13. When the 2-1 manual band servo releases, the ball check valve unseats and fluid exhausts without going through orifice 13. ***The D3 and D2 circuits are connected in this version.***

Figure 85

INTERNAL DIFFERENCES (CONT'D)

Channel Plate

G.M. and Volvo both use the "Geartronic/Tiptronic" shift strategy which allows for engine braking in 1st, 2nd and 3rd gears manually. To accommodate this shift strategy, hydraulic changes were made to the channel plate, in the worm track area. The changes in the worm track passages are highlighted, and the significant changes are shown inside of the circles in Figure 86. The major changes are in the manual valve area of the valve body. The checkballs are in the same locations and perform the same functions in both versions of the channel plates, as shown in Figure 86. The Low Blow-Off Ball line up however, is different between the "Conventional" and the "Geartronic/Tiptronic versions, as described below, and is also shown in Figure 86.

CONVENTIONAL PRNDL VERSION

Low Blow-Off Ball Lineup:

The Conventional PRNDL Version has a low blow-off ball, located in the channel plate, as shown in Figure 86. It is a pressure relief ball that exhausts LO-1st fluid pressures above 448 kPa (65 psi) in the 3rd clutch apply circuit, when in Manual Low.

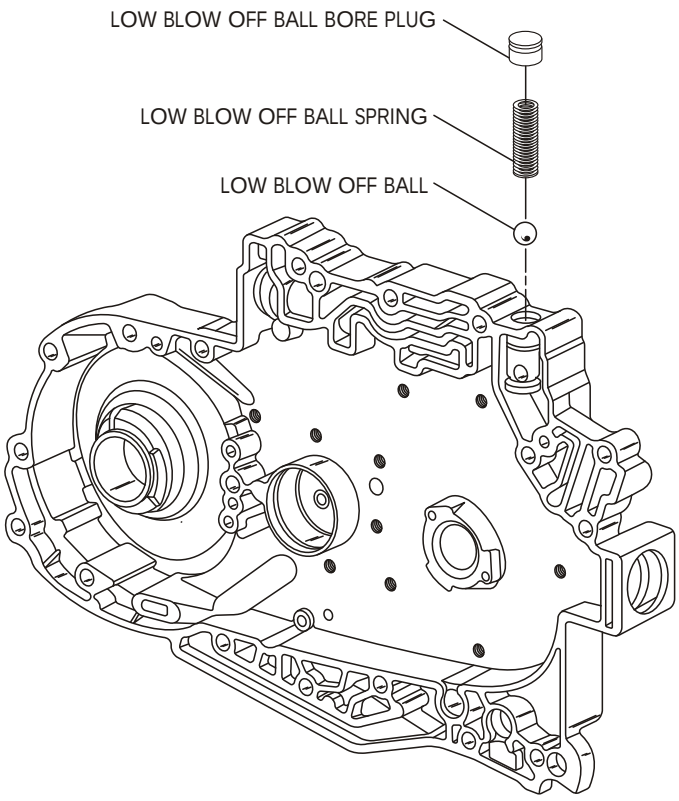
GEARTRONIC/TIPTRONIC VERSION

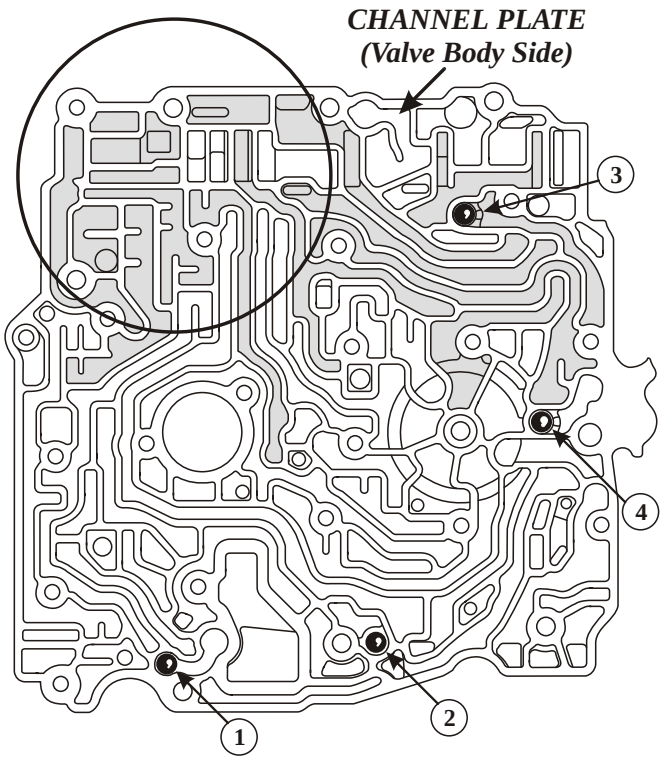
Low Regulator Valve Lineup:

The Geartronic/Tiptronic Version uses a low regulator valve, located in the channel plate, as shown in Figure 86. It is a spool type regulating valve that regulates engine braking 1st gear fluid into the low regulator fluid circuit. Low regulator fluid is used to apply the third clutch when in . Manual Low.

Continued on Page 101

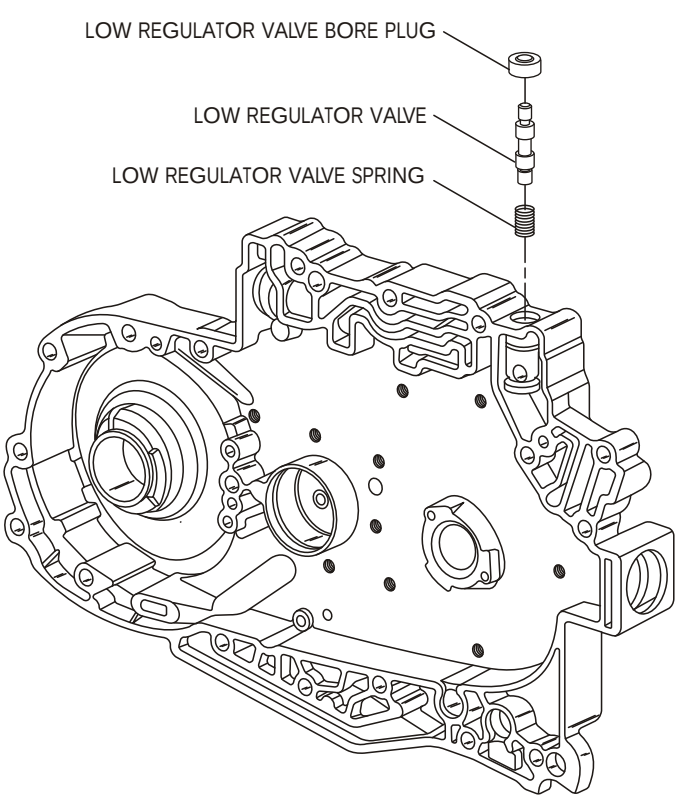
CONVENTIONAL PRNDL VERSION

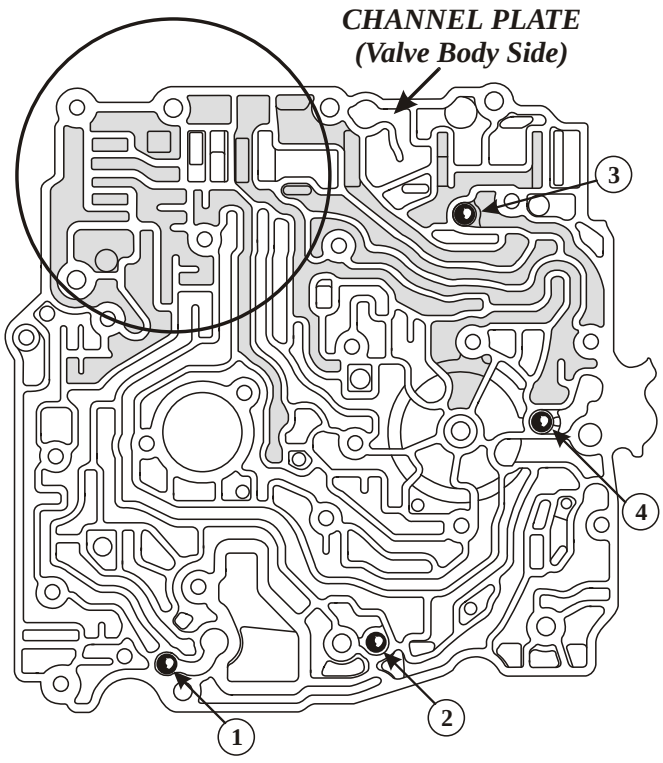




Checkball Function and Locations in the Channel Plate are the same for both versions.

GEARTRONIC/TIPTRONIC VERSION





Checkball Function and Locations in the Channel Plate are the same for both versions.

Figure 86

INTERNAL DIFFERENCES (CONT'D)

Manual Valve And Manual Valve Link

We have illustrated in Figure 87, all of the manual valve and manual valve link combinations that we know of at the time of this printing. Notice the difference in the length of the manual valve and links, between the internal mode switch models, and the models that do not use the internal mode switch. In some of the later model years you will find the "Spring Clip" method of connecting to the manual valve, instead of the "Coiled" Spring method. Keep in mind that ***ALL*** Volvo vehicles use the internal mode switch.

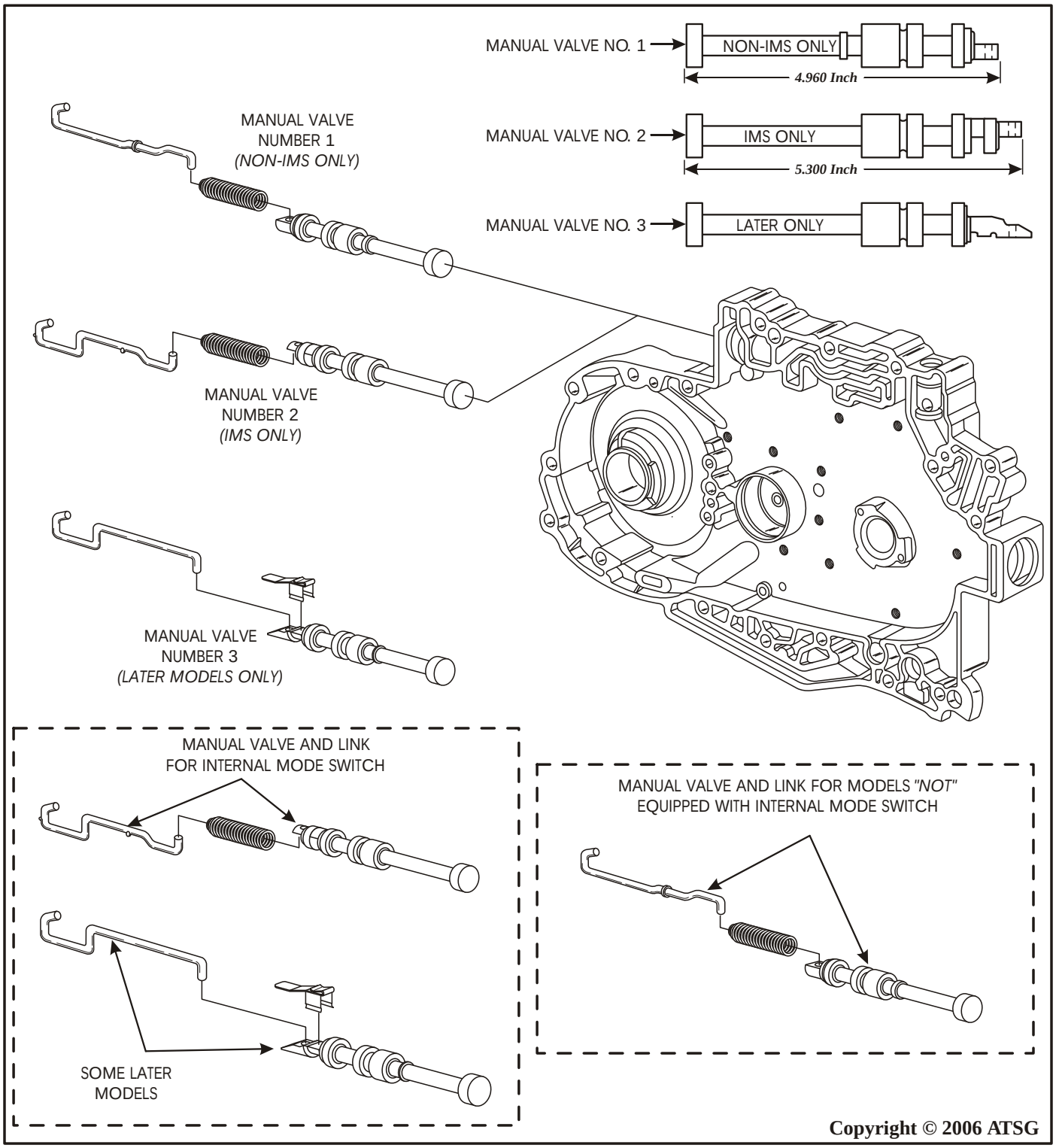


Figure 87

INTERNAL DIFFERENCES (CONT'D)

Valve Body Spacer Plate

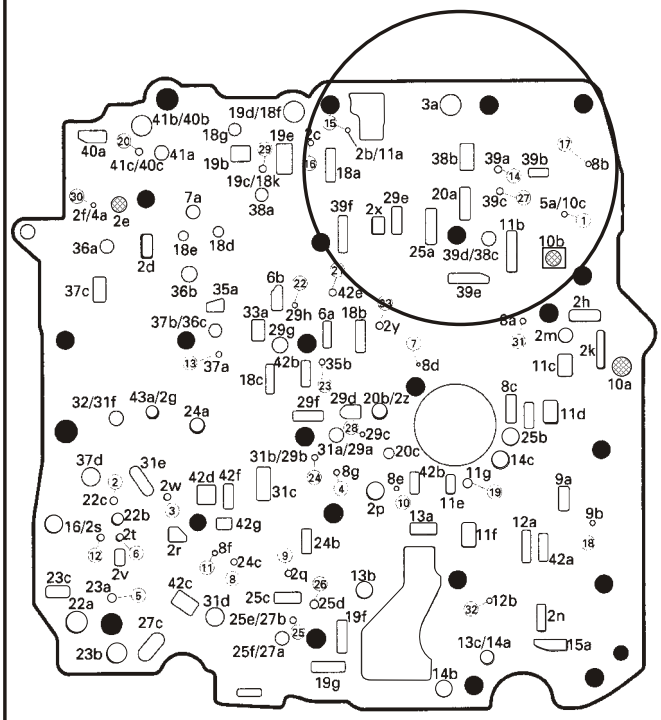
G.M. and Volvo both use the "Geartronic/Tiptronic" shift strategy which allows for engine braking in 1st, 2nd and 3rd gears manually. To accommodate this shift strategy, hydraulic changes were made to the spacer plate. The significant changes in the passages are highlighted, and are shown inside of the circles in Figure 88. The major changes are in the manual valve area of the spacer plate.

Spacer plate notch identification is also shown in Figure 88. One notch is the Conventional version, and two notches is the Tiptronic version. Notice also that the Tiptronic version has a hole that the Conventional version does not have. Volvo spacer plates have the gaskets bonded to them, and available under the following part numbers.

Volvo "Conventional" version 30651257
Volvo "Tiptronic Version 30651253

CONVENTIONAL PRNDL VERSION

Spacer Plate



GEARTRONIC/TIPTRONIC VERSION

Spacer Plate

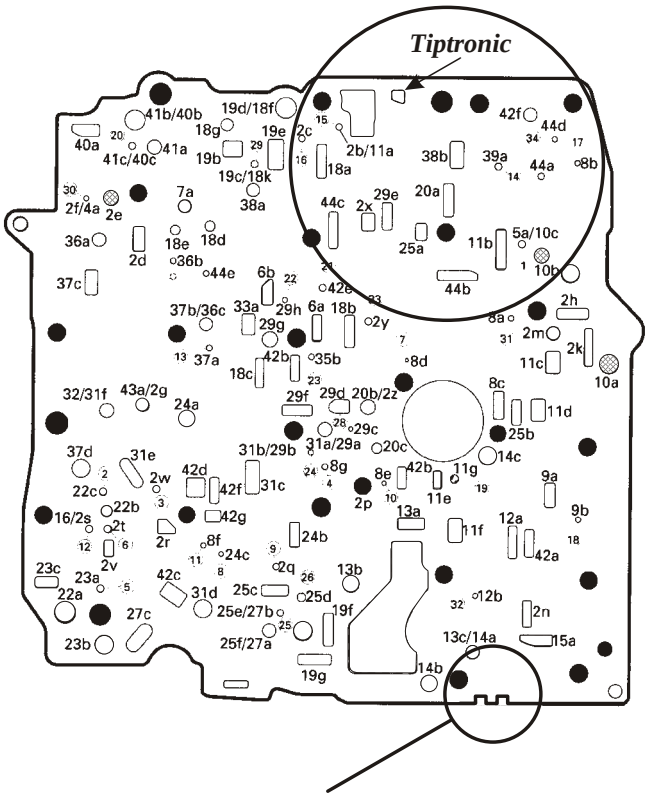


Figure 88

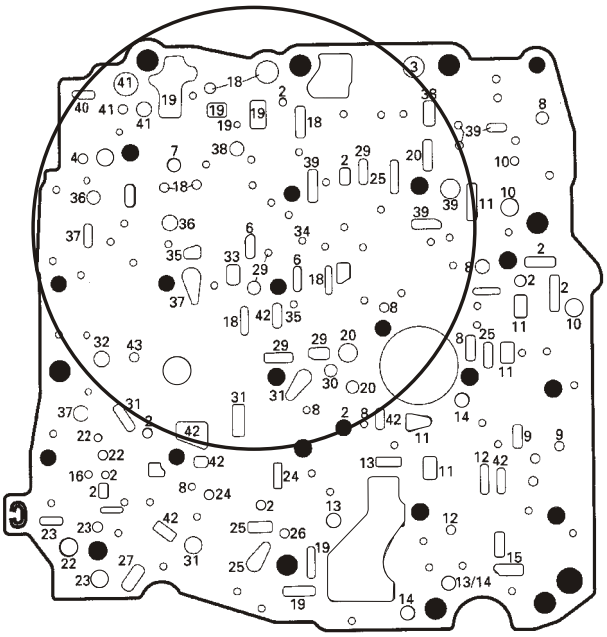
INTERNAL DIFFERENCES (CONT'D)

Valve Body Gaskets

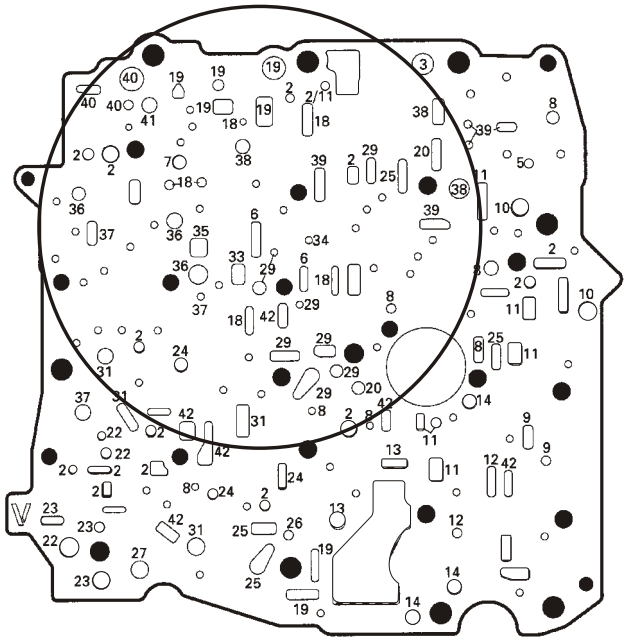
Because of the differences in the hydraulics of the valve body, spacer plate and channel plate, obviously, the spacer plate gaskets must also be different to accommodate the changes, as shown in Figure 89.

The easiest form of identification is the location of tab on the gaskets that contains the "C" or the "V", as shown in Figure 89. Tabs are closer to bottom pan on the Conventional, and closer to the manual valve on the Geartronic/Tiptronic.

CONVENTIONAL PRNDL VERSION

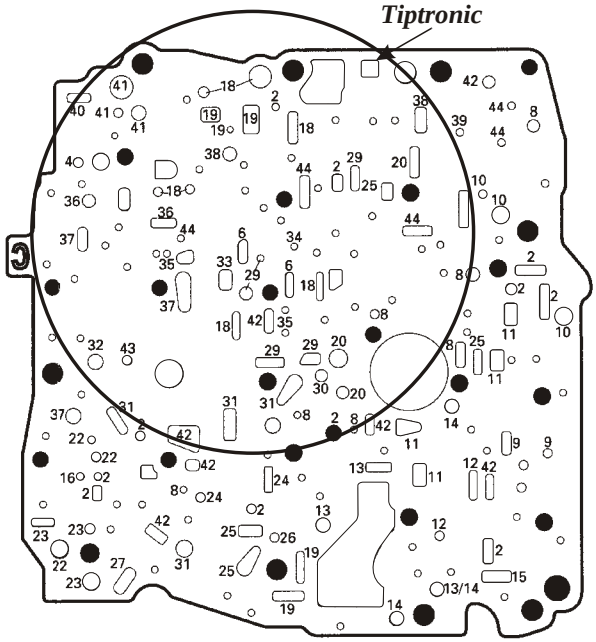


Gasket (Channel Plate to Spacer Plate)

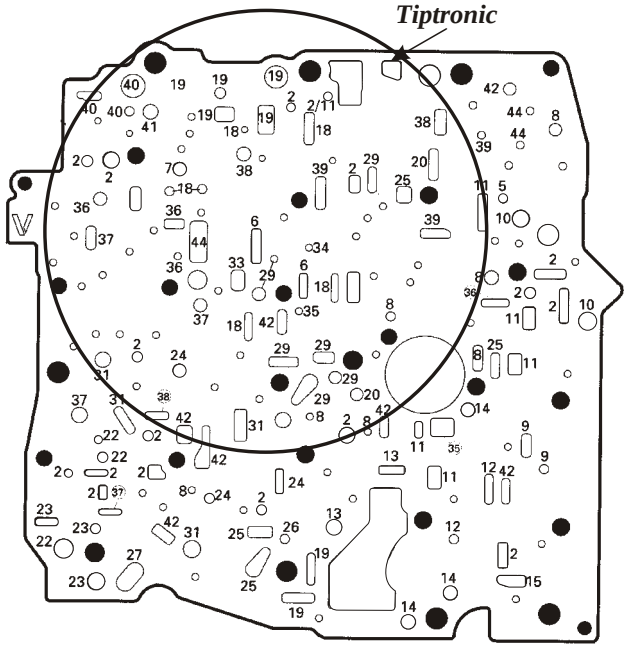


Gasket (Spacer Plate to VB)

GEARTRONIC/TIPTRONIC VERSION



Gasket (Channel Plate to Spacer Plate)



Gasket (Spacer Plate to VB)

Figure 89

INTERNAL DIFFERENCES (CONT'D)

Input Speed Sensor

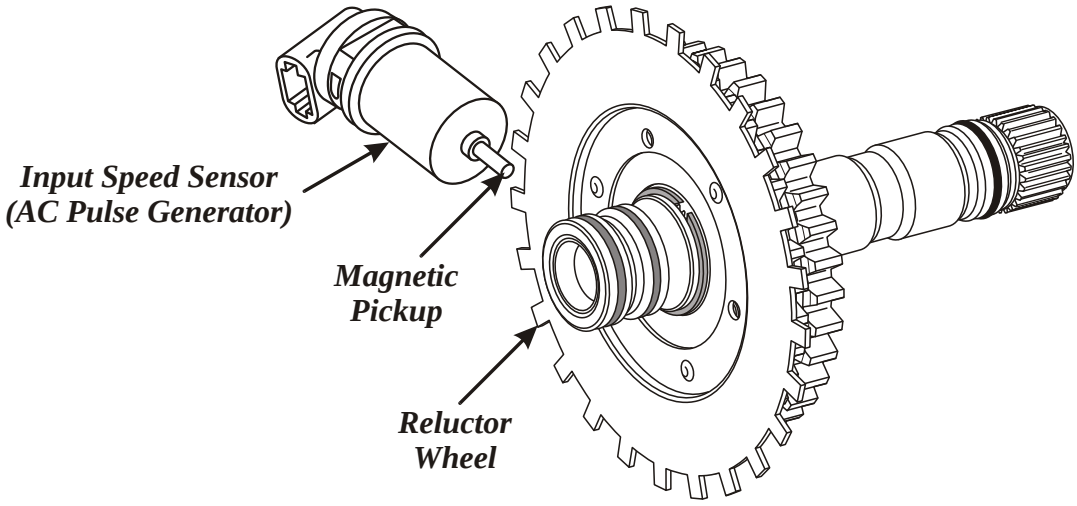
The Input Speed Sensor is located in the channel plate, and excited by a reluctor on the drive sprocket. The North American version is a Permanent Magnet type, while the Volvo version is a Hall Effect type.

In Figure 90, the top illustration shows the Permanent Magnet type which is found in all GM vehicles, and has a small metal tip protruding from the sensor, while the bottom illustration shows the Hall Effect type found in all Volvo vehicles, which has no metal tip protruding from the sensor.

Although a ***typical*** Hall Effect Speed Sensor has three wires, the Volvo version is a two wire Hall Effect Speed Sensor. The third wire is contained inside the sensor. It is easy to put the wrong sensor in either version transaxle, as the connectors are identical. This will cause an incorrect signal and transmission gear ratio problems. Operation of both type of Input Speed Sensors is found on Page 105.

INTERNAL DIFFERENCES
Continued on Page 106

ALL GENERAL MOTORS VEHICLES



ALL VOLVO VEHICLES

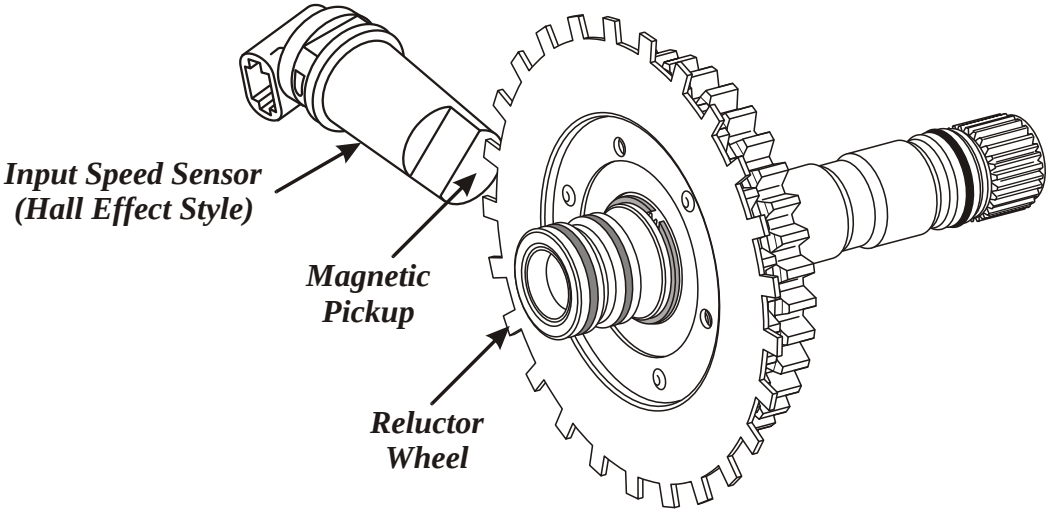


Figure 90

AC Voltage Generator Operation

The schematic shown in Figure 91 is the Input Speed Sensor circuit found in the General Motors version of the 4T65E. This input speed sensor is the AC Voltage Generator type. It sends AC voltage to the PCM where it is buffered internally in order to convert the AC voltage to a DC voltage signal that is pulsed to ground by the buffer. This is done because automotive computers do not understand AC voltage as a language. This signal can also be measured in Hertz which is the frequency of the signal. For example, the specs on the input speed sensor are at least 0.1 volt AC @ 3 mph and approximately 33 Hz @ 30 mph.

This signal is best tested with a scope.

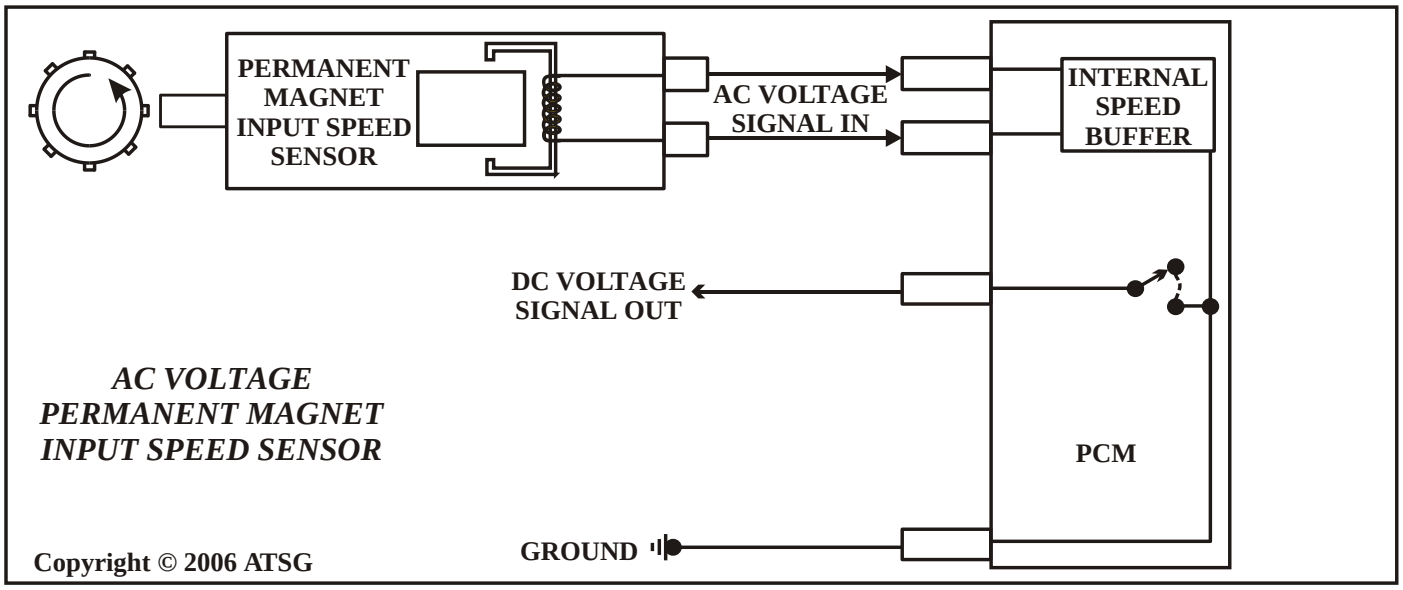


Figure 91

Hall Effect Sensor Operation (2 Wire)

The schematic in Figure 92 is the Input Speed Sensor Circuit found in the Volvo S80 with 4T65E-V. This input speed sensor is a Hall Effect type. What makes this sensor different is instead of the typical 3 wire arrangement, it only has two (2) wires. The third wire is incorporated inside the speed sensor and is controlled by a capacitor, which is also incorporated inside the speed sensor, as shown in Figure 92.

This sensor receives voltage from the PCM, and the sensor toggles this reference voltage between zero and five volts. Internally the PCM reads this signal as 0-5-0-5-0-5 which it uses to calculate turbine speed. This signal can be tested with a volt meter using the MIN/MAX feature, or a scope.

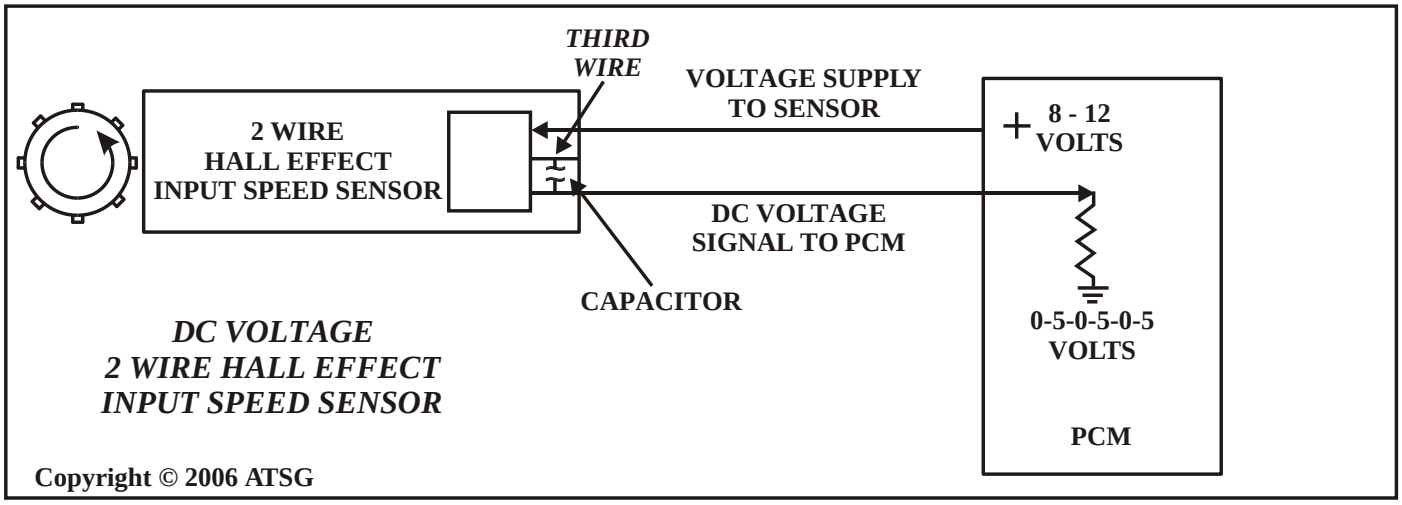


Figure 92

INTERNAL DIFFERENCES (CONT'D)

Drive Sprocket/Drive Sprocket Support Thrust Washer

The Drive Sprocket to Drive Sprocket Support Thrust Washer is also different, between the General Motors version and the Volvo version of the 4T65-E transaxle, as shown in Figure 93. The Volvo thrust washer is a larger diameter and Gray in color, as shown in Figure 93. The General Motors thrust washer is a smaller diameter and Natural in color, as shown in Figure 93.

This also changes the drive sprocket pattern where the holes are drilled to accept the washer tabs. The General Motors drive sprocket actually has two different drill pattern circles, as shown in Figure 93. The thrust washer fits the smaller drill pattern circle, and the reluctor wheel fits into the larger drill pattern circle, as shown in Figure 93. The Volvo drive sprocket has only one drill pattern circle, and the washer goes in one set of holes and the reluctor wheel goes in the other set, as shown in Figure 93.

The washer tabs are also longer on the Volvo version thrust washer, as shown in Figure 94. With both the reluctor wheel and thrust washer installed, the Volvo washer tabs will protrude through the holes in the reluctor wheel, as shown in Figure 94. The General Motors thrust washer does not protrude through the reluctor wheel holes. Obviously these thrust washers will not interchange.

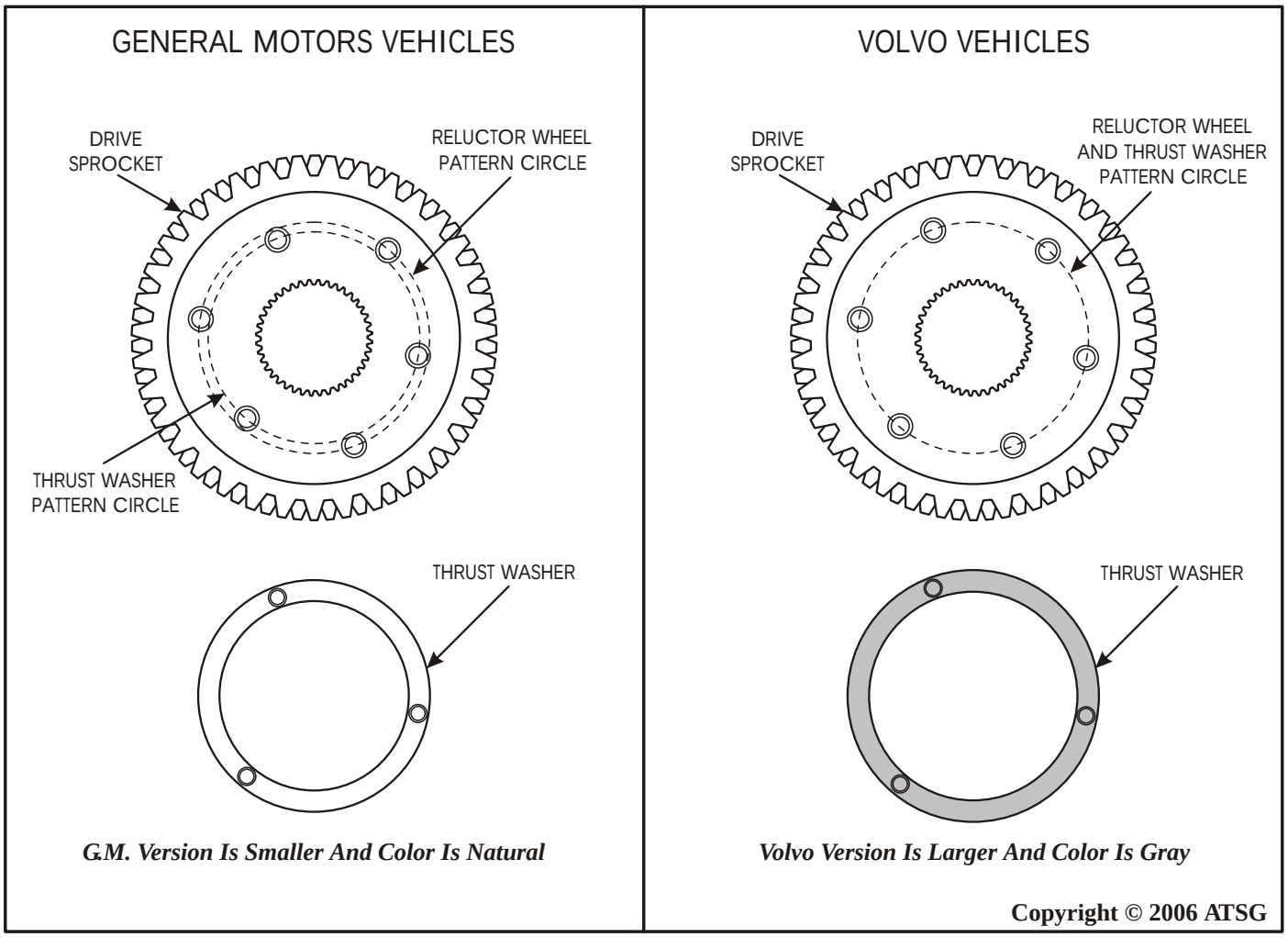


Figure 93

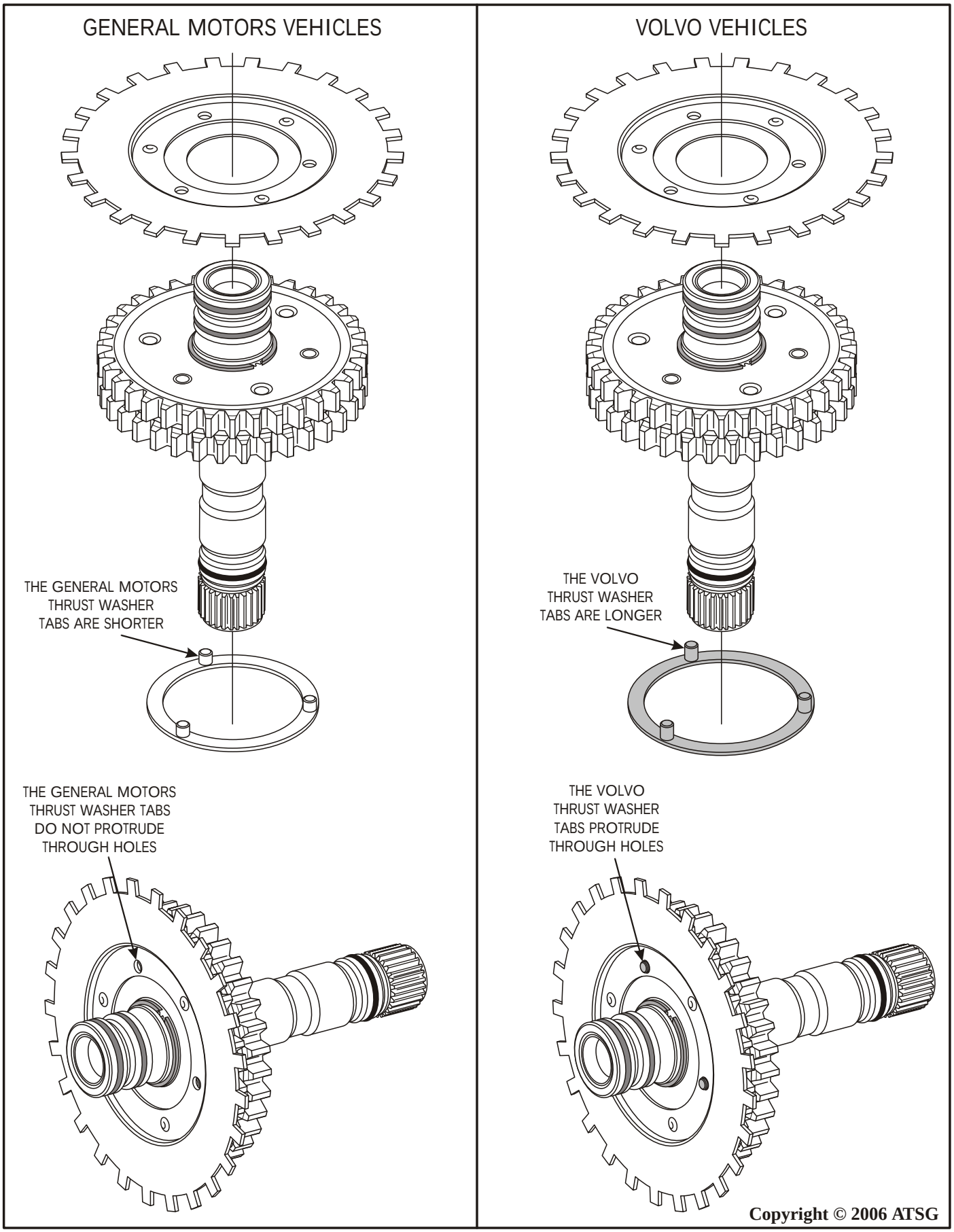


Figure 94

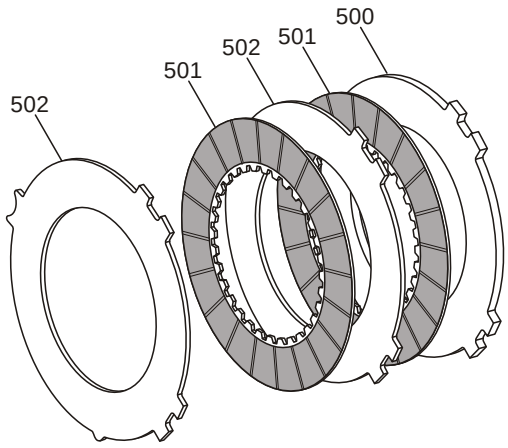
INTERNAL DIFFERENCES (CONT'D)

Fourth Clutch Plates

Currently, General Motors uses the typical combination of steel plates and friction plates, for the fourth clutch stack up, as shown in Figure 95. Volvo uses the typical single sided inside spline plates, and single sided outside spline plates for their fourth clutch stack up, as shown in Figure 95.
The "Word On The Street" is that General Motors is going to the single sided set up on some models in the future, so look for them in G.M. also.

GENERAL MOTORS MODELS

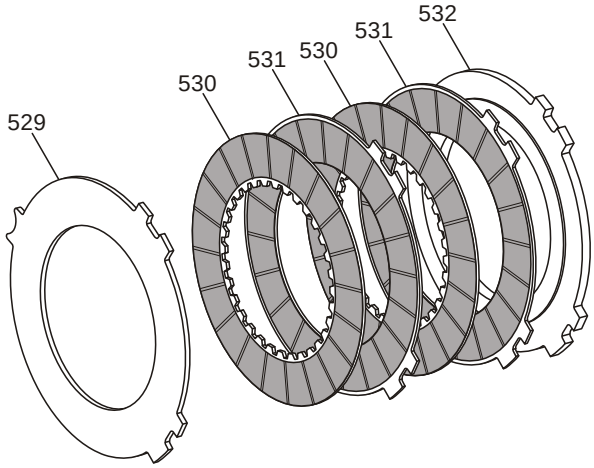
Typical 4th clutch stack up using friction and steel plates



500 4TH CLUTCH APPLY PLATE.
501 4TH CLUTCH FRICTION PLATE.
502 4TH CLUTCH STEEL PLATE.

VOLVO MODELS

Single sided internally and externally splined 4th clutch friction plates



529 4TH CLUTCH BACKING PLATE.
530 4TH CLUTCH SINGLE SIDED INTERNAL SPLINE PLATE.
531 4TH CLUTCH SINGLE SIDED EXTERNAL SPLINE PLATE.

Figure 95

INTERNAL DIFFERENCES (CONT'D)

Output Shaft Assembly

The Volvo output shaft assembly is approximately 1/8 inch longer than the General Motors version, on the 4th clutch hub end, as shown in Figure 96. The snap ring and groove move the same 1/8 inch. No positive way of identification at the time of this printing, other than comparison, for the difference in length. There is also a "heavy duty" version available in both General Motors version and the Volvo version. The "heavy duty" output shaft is identified by the presence of the shoulder, as shown in Figure 97.

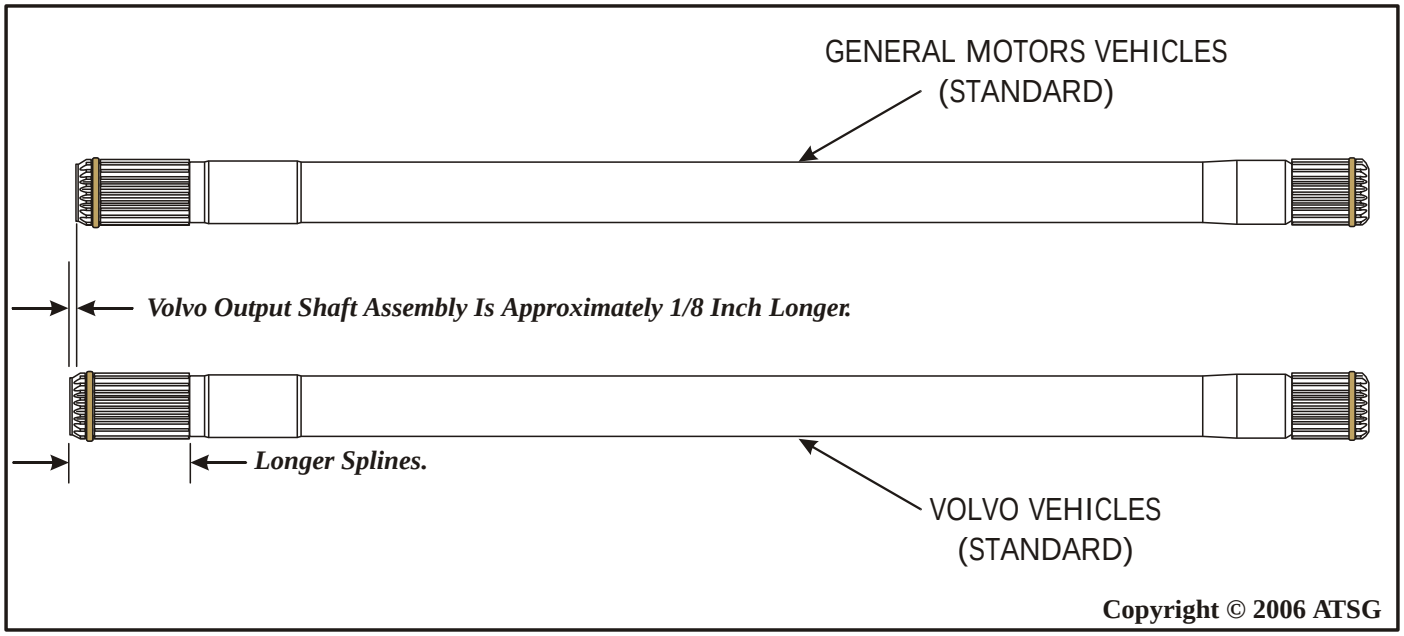


Figure 96

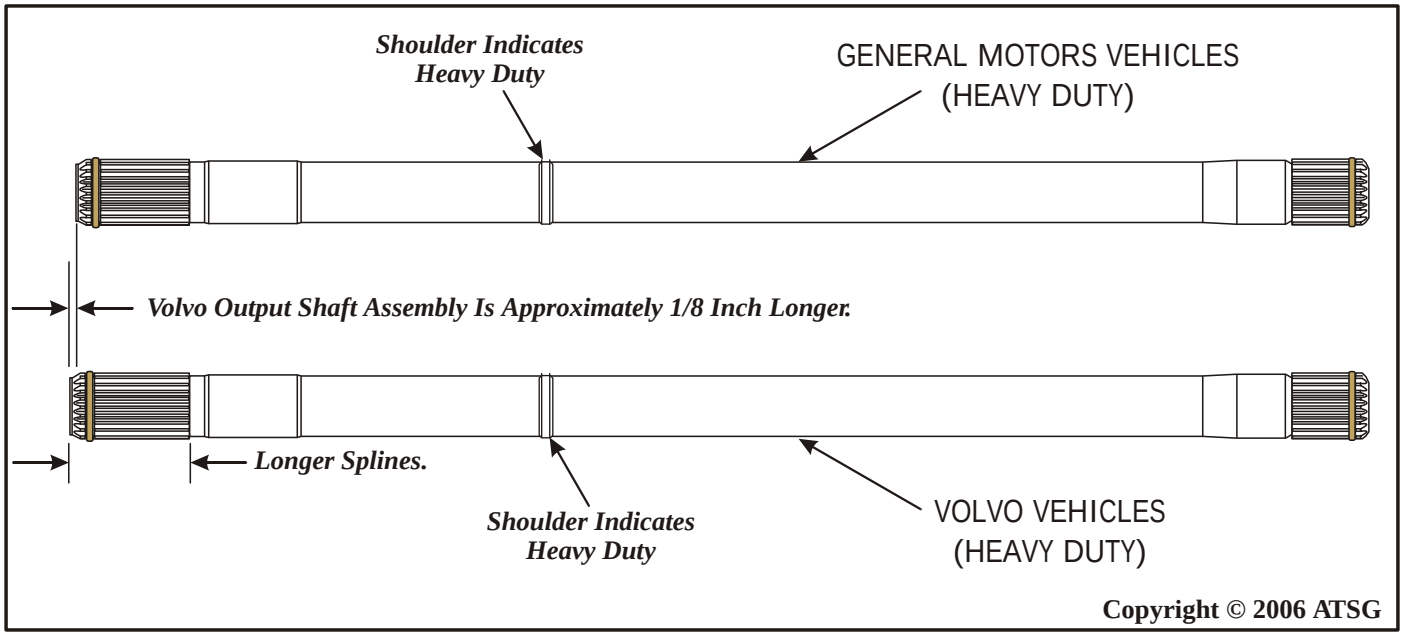


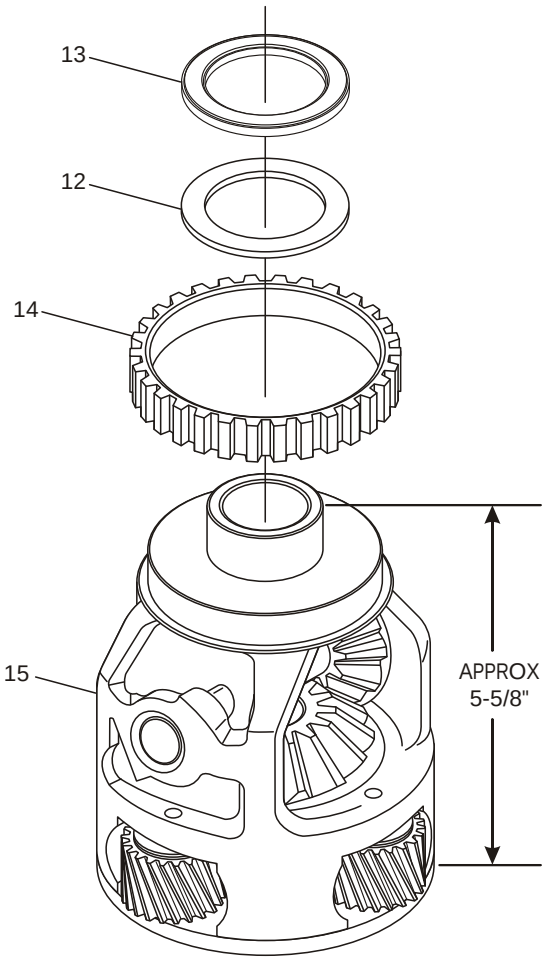
Figure 97

INTERNAL DIFFERENCES (CONT'D)

Final Drive Assembly

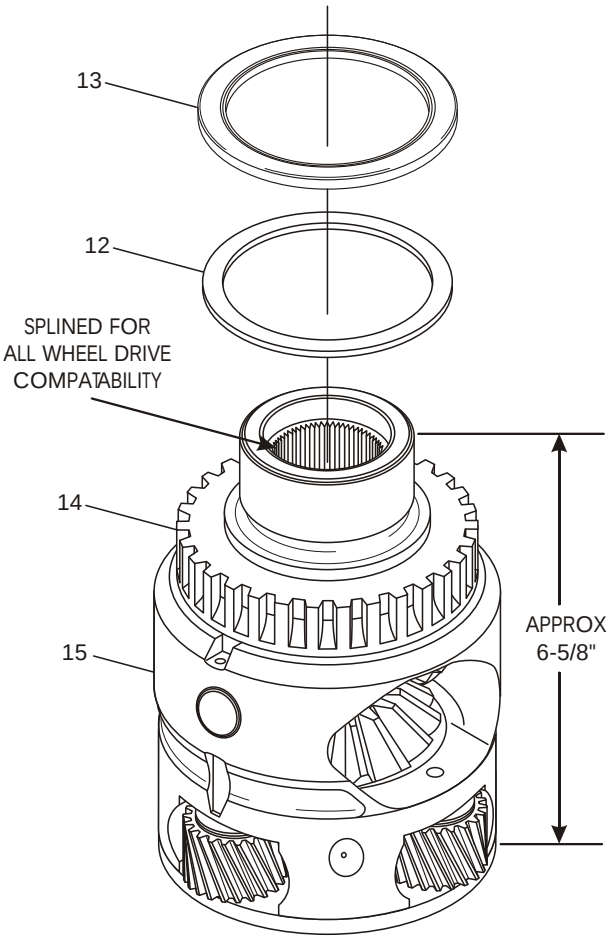
The Volvo final drive housing is approximately one inch longer than the General Motors version, as shown in Figure 98, and the output speed sensor reluctor is actually machined into the final drive housing, larger in diameter than the G.M., but both have 30 teeth. The Volvo final drive housing is approximately 6-5/8 inches in length, and the General Motors final drive housing is approximately 5-5/8 inches in length, as shown in Figure 98 and 99. Notice also, in Figure 98, that the sleeved shoulder that rides in the caged needle bearing, is much larger. This also changes the caged needle bearing, selective thrust washer and the thrust bearing, to accommodate the larger dimensions. The Volvo final drive housing also is splined on the inside diameter of the larger shoulder, as shown in Figure 98, to make it compatable for use in "All Wheel Drive" vehicles. Volvo uses a "Viscous Clutch" in the differential in ***some*** applications as well. At the time of this printing, we have found only the final drive ratio of 3.29 used in the Volvo. Complete sprocket and final drive ratio information for the Volvo units, begins on Page 114 of this manual.

GENERAL MOTORS VEHICLES



12 FINAL DRIVE SELECTIVE THRUST WASHER.
13 FINAL DRIVE TO EXTENSION HOUSING THRUST WASHER.
14 OUTPUT SPEED SENSOR RELUCTOR WHEEL.

VOLVO VEHICLES



12 FINAL DRIVE SELECTIVE THRUST WASHER.
13 FINAL DRIVE TO EXTENSION HOUSING THRUST WASHER.
14 OUTPUT SPEED SENSOR RELUCTOR, MACHINED IN HOUSING.

Figure 98

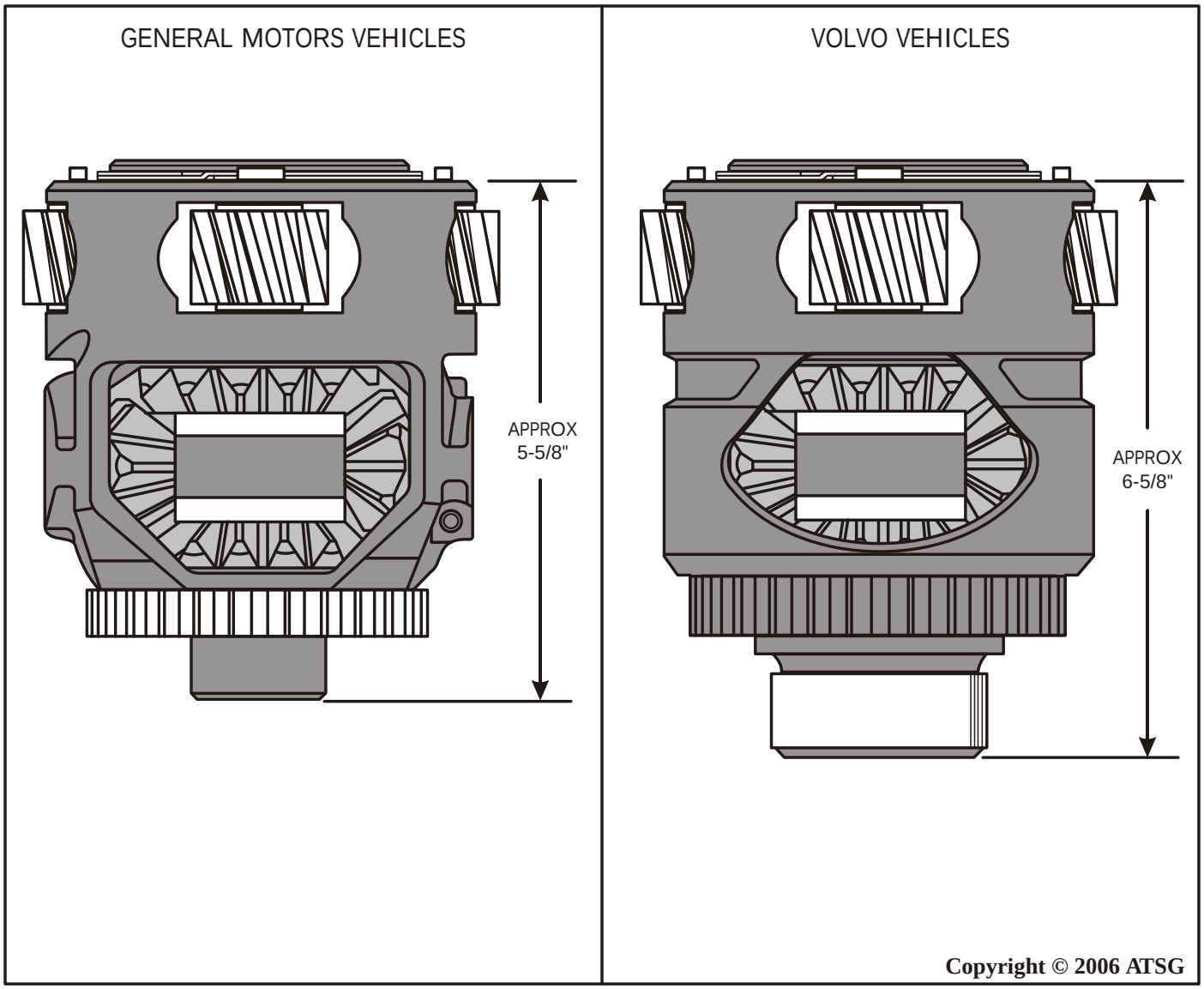


Figure 99

INTERNAL DIFFERENCES (CONT'D)

Extension Housing

The Volvo extension housing assembly is approximately one inch longer than the General Motors version, as shown in Figure 100, to accommodate the larger final drive assembly. The output speed sensor also goes in at a different angle. Refer to Figure 100.

Extension Housing Caged Needle Bearing

The Volvo extension housing caged needle bearing is also much larger than the General Motors version, as shown in Figure 100, to accommodate the larger shoulder on the final drive housing.

Final Drive To Extension Housing Thrust Bearing

The Volvo final drive to extension housing thrust bearing is larger than the General Motors version, as shown in Figure 98 and 100, to accommodate the larger shoulder on the final drive housing.

Final Drive Selective Thrust Washer

The Volvo final drive "selective" thrust washer is also larger than the General Motors version, as shown in Figure 98 and 100, to accommodate the larger shoulder on the final drive housing.

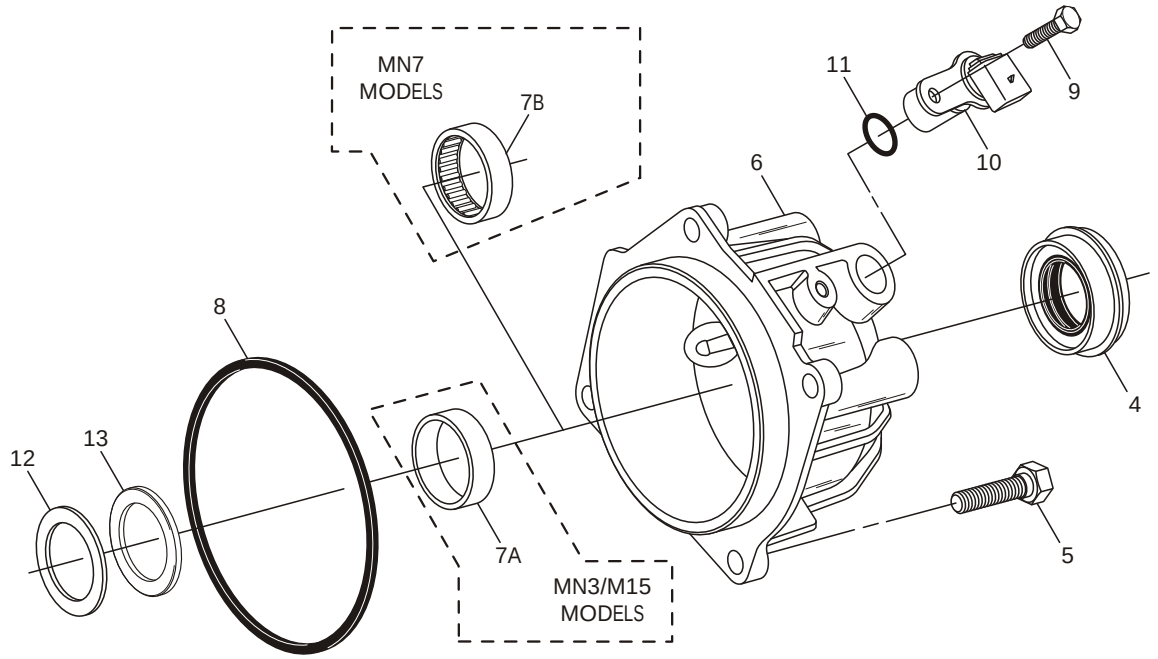
Right Hand Axle Seal

The Volvo right hand axle seal is also larger than the General Motors version, as shown in Figure 100, to accommodate the larger caged needle bearing and the larger shoulder on the final drive housing.

Output Speed Sensor

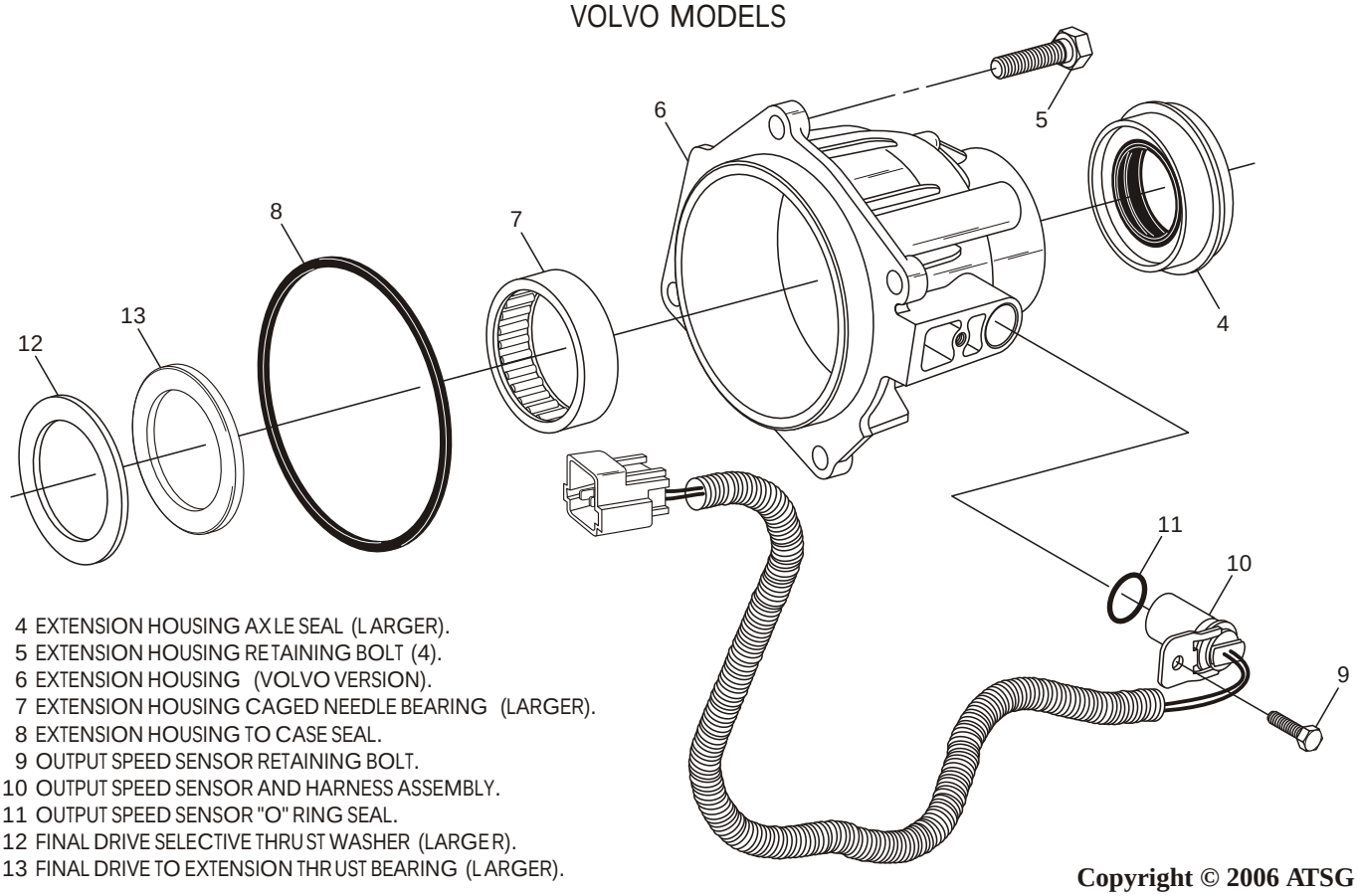
The Volvo output speed sensor has a shorter body than the General Motors version, as shown in Figure 100, to accommodate the larger diameter of the reluctor wheel machined into the final drive housing, which is shown in Figure 98. The Volvo output speed sensor is also equipped with a non-removeable wire harness, that runs up to the top of the transaxle case, as shown in Figure 100.

GENERAL MOTORS MODELS



4 EXTENSION HOUSING AXLE SEAL.
5 EXTENSION HOUSING RETAINING BOLT (4).
6 EXTENSION HOUSING (G.M. VERSION).
7A EXTENSION HOUSING BUSHING (MN3/M15 MODELS).
7B EXTENSION HOUSING CAGED NEEDLE BEARING (MN7 MODELS).
8 EXTENSION HOUSING TO CASE SEAL.
9 OUTPUT SPEED SENSOR RETAINING BOLT.
10 OUTPUT SPEED SENSOR.
11 OUTPUT SPEED SENSOR "O" RING SEAL.
12 FINAL DRIVE SELECTIVE THRUST WASHER.
13 FINAL DRIVE TO EXTENSION HOUSING THRUST BEARING.

VOLVO MODELS



4 EXTENSION HOUSING AXLE SEAL (LARGER).
5 EXTENSION HOUSING RETAINING BOLT (4).
6 EXTENSION HOUSING (VOLVO VERSION).
7 EXTENSION HOUSING CAGED NEEDLE BEARING (LARGER).
8 EXTENSION HOUSING TO CASE SEAL.
9 OUTPUT SPEED SENSOR RETAINING BOLT.
10 OUTPUT SPEED SENSOR AND HARNESS ASSEMBLY.
11 OUTPUT SPEED SENSOR "O" RING SEAL.
12 FINAL DRIVE SELECTIVE THRUST WASHER (LARGER).
13 FINAL DRIVE TO EXTENSION THRUST BEARING (LARGER).

Figure 100

INTERNAL DIFFERENCES (CONT'D)

Sprocket And Final Drive Ratios

The Volvo transaxle identification tag is where you will find the model code, as shown in Figure 102, which is needed to determine the proper ratio for the model you are repairing. Using the model code with the proper year, refer to the charts on the following pages to determine proper ratio.

We have included all of the Volvo sprocket ratios and final drive ratios that were available at the time of this printing. Keep in mind that ***all*** Volvo vehicles use the internal mode switch, so we did not include that information in the chart.

The converter code "FLTV" on the converter ID tag, as shown in Figure 101 is the code needed to get a torque converter with the proper "K" factor, and thus the proper stall speed. This converter code is also supplied in the charts beginning on the following page.

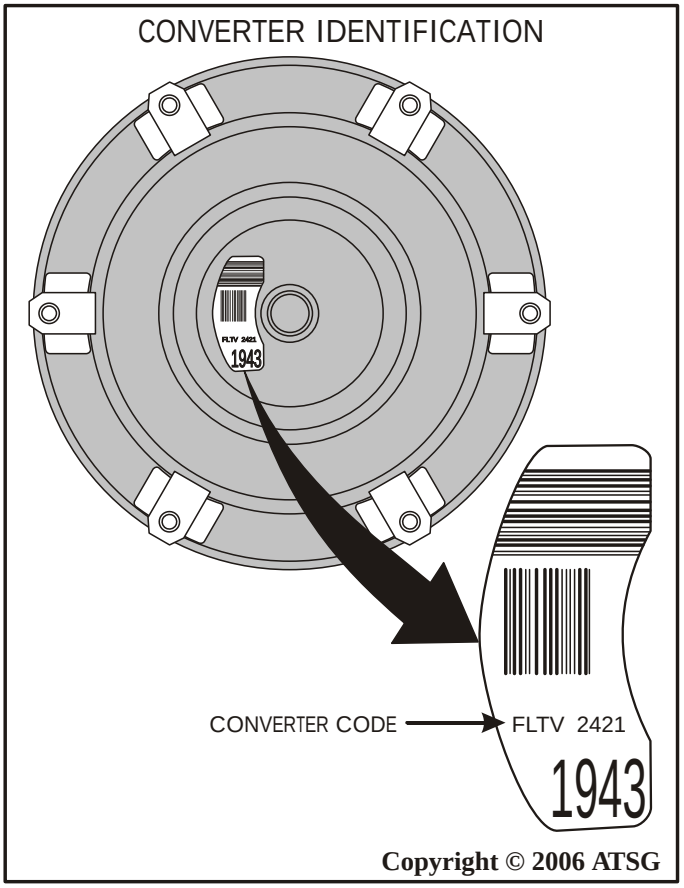


Figure 101

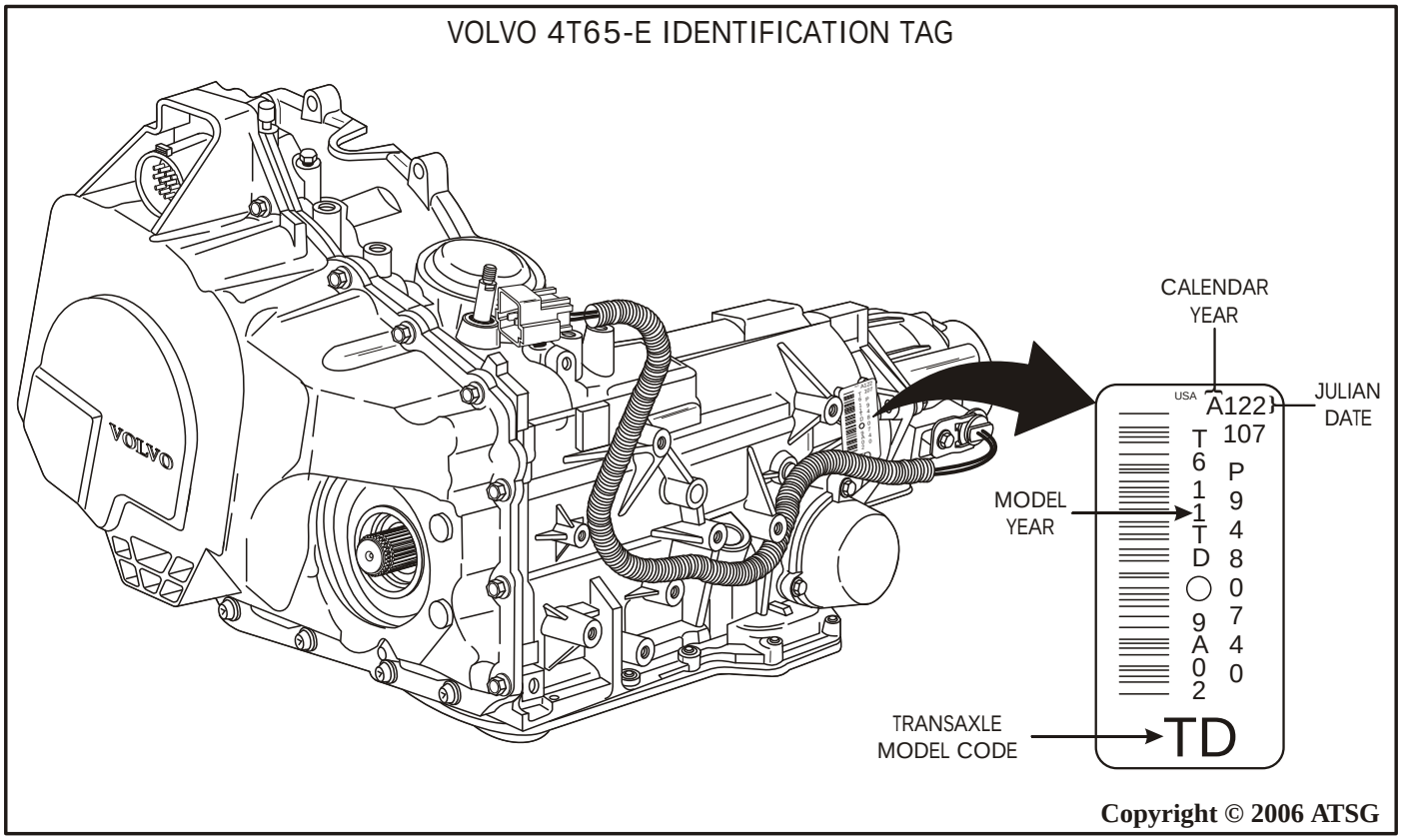


Figure 102

1999 "VOLVO" THM 4T65E MODELS							
Model Code	Body	Engine/Vehicle	Final Drive Ratio	Sprockts Drve/Drvn	Conv Code	Conv Diam	"K" Factor
9TAB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
9TDB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
9TKB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163

2000 "VOLVO" THM 4T65E MODELS							
Model Code	Body	Engine/Vehicle	Final Drive Ratio	Sprockts Drve/Drvn	Conv Code	Conv Diam	"K" Factor
0TAB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
0TDB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
0TKB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
0TMB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
0TNB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
0TRB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163

2001 "VOLVO" THM 4T65E MODELS							
Model Code	Body	Engine/Vehicle	Final Drive Ratio	Sprockts Drve/Drvn	Conv Code	Conv Diam	"K" Factor
1TAB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
1TDB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
1TKB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163

2002 "VOLVO" THM 4T65E MODELS							
Model Code	Body	Engine/Vehicle	Final Drive Ratio	Sprockts Drve/Drvn	Conv Code	Conv Diam	"K" Factor
2TAB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
2TDB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
2TKB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163

2003 "VOLVO" THM 4T65E MODELS							
Model Code	Body	Engine/Vehicle	Final Drive Ratio	Sprockts Drve/Drvn	Conv Code	Conv Diam	"K" Factor
3TAB	S80	2.8L Turbo, Volvo	3.29	35/35	FMVV	245mm	131
3TDB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
3TKB	S80	3.0L. Volvo	3.29	33/37	FLTV	245mm	163
3TPB	S80	2.8L Turbo, Volvo	3.29	33/37	FMVV	245mm	131

Figure 103

2004 "VOLVO" THM 4T65E MODELS							
Model Code	*Body*	*Engine/Vehicle*	*Final Drive Ratio*	*Sprockts Drve/Drvn*	*Conv Code*	*Conv Diam*	*"K" Factor*
4TAB	*S80*	*2.8L Turbo, Volvo*	*3.29*	*35/35*	*FMVV*	*245mm*	*131*
4TDB	*S80*	*3.0L. Volvo*	*3.29*	*33/37*	*FLTV*	*245mm*	*163*
4TKB	*S80*	*3.0L. Volvo*	*3.29*	*33/37*	*FLTV*	*245mm*	*163*
4TPB	*S80*	*2.8L Turbo, Volvo*	*3.29*	*33/37*	*FMVV*	*245mm*	*131*

2005 "VOLVO" THM 4T65E MODELS							
Model Code	*Body*	*Engine/Vehicle*	*Final Drive Ratio*	*Sprockts Drve/Drvn*	*Conv Code*	*Conv Diam*	*"K" Factor*
5TAB	*S80*	*2.8L Turbo, Volvo*	*3.29*	*35/35*	*FMVV*	*245mm*	*131*
5TDB	*S80*	*3.0L. Volvo*	*3.29*	*33/37*	*FLTV*	*245mm*	*163*
5TKB	*S80*	*3.0L. Volvo*	*3.29*	*33/37*	*FLTV*	*245mm*	*163*
5TPB	*S80*	*2.8L Turbo, Volvo*	*3.29*	*33/37*	*FMVV*	*245mm*	*131*

Figure 104

Notes

Notes