

A Look at the GM 6L80; Part 1



by Steve Garrett



Figure 1

Cadillac STS-V
Hydra-Matic
2006 6L80 (MYC)
Six Speed RWD
Automatic Transmission

Introduction

The first of ten new 6-speed automatics, the 6L80 was introduced for the 2006 model year (Figure 1). The 6L80 (RPO MYC) is currently available in the Corvette; Cadillac XLR-V; Cadillac STS-V; Chevrolet, Cadillac and GMC C/K trucks; and the Hummer H2 platforms.

Features

- Input torque capacity: 430 lb-ft (583 Nm)
- Output torque capacity: 664 lb-ft (900 Nm)
- Ratios:
 - 1st — 4.02:1
 - 2nd — 2.36:1
 - 3rd — 1.53:1
 - 4th — 1.15:1
 - 5th — 0.85:1
 - 6th — 0.67:1

- Maximum shift speed: 6500 RPM
- Maximum GVW: 8600 lbs
- Maximum GCVW: 14000 lbs
- PRNDL positions: P, R, N, D, (S or M)
- 2 shift solenoids (On/Off design): SS1, SS2
- 6 PWM pressure control solenoids: PCS1, PCS2, PCS3, PCS4, PCS5, TCC

- 32-bit TCM (TEHCM) mounted inside the transmission on the valve body (referred to as the *control solenoid valve assembly*). The TEHCM incorporates the TCM, solenoids, pressure switches and TFT, and is bolted to the valve body.
- EC3 Converter 300mm (Corvette) 258mm twin plate (XLR-V and STS-V)
- Fluid required: Dexron VI
- Clutch-to-clutch shifts; 5 clutches, 1 sprag
- Planetary assemblies: Input — Simpson; Output — Dual Pinion

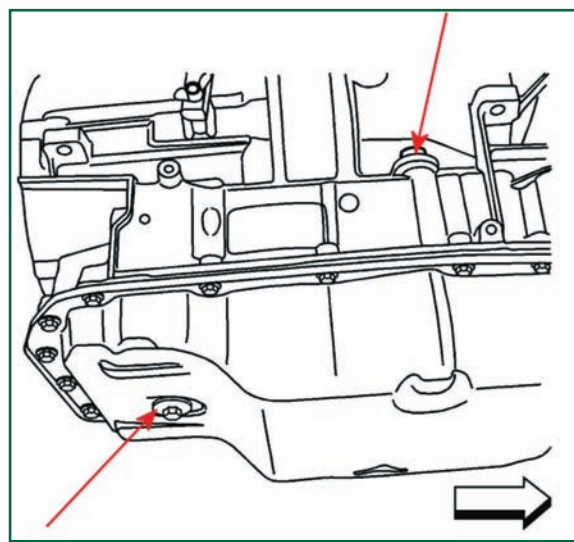
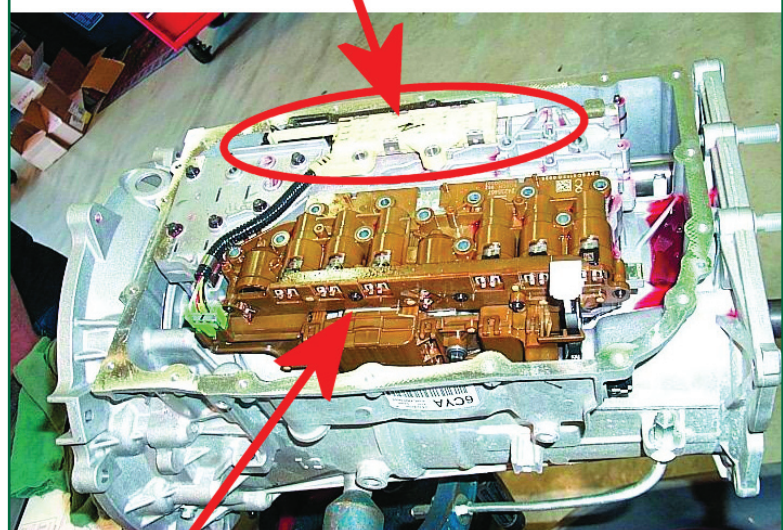


Figure 2

NSBU/PRNDL/IMS Switch and Manual Valve



Solenoid Pack/Block Assembly (TEHCM)

Figure 3

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- Vane-style oil pump
- Internally-mounted input and output shaft, and Hall Effect speed sensors
- Internal Mode Switch (IMS)
- Performance Algorithm Shifting (PAS) programming
- Performance Algorithm Lift foot (PAL) programming
- Sport mode and TAP shift
- Adaptive strategies with fast learn capabilities
- Up to 75 transmission-only DTCs

Checking Fluid Level

The 6L80 transmission requires an unusual process for checking its fluid level. Many 6L80 applications don't have a dipstick; there's a plug in the dipstick hole. The plug can be removed and the hole used as a fill point for transmission fluid (Figure 2). Here's how to check the fluid level:

Bring the transmission fluid temperature between 86°–122°F (30°–50°C). You can verify this using a scan tool, the driver information center, or the transmission gauge.

If the transmission has a dipstick, use that to check the fluid level; on applications without a dipstick:

- Park the vehicle on level ground.
- Start the engine and let it idle.
- Shift the transmission through each range, pausing in each range for about 3 seconds to give the clutches a chance to fill.
- Place the transmission in park.
- Remove the level control plug located in the transmission

Selector Position	Range A	Range B	Range C	Range P
Park	Low	High	High	Low
Park/Reverse	Low	Low	High	Low
Reverse	Low	Low	High	High
Reverse/Neutral	High	Low	High	High
Neutral	High	Low	High	Low
Neutral/D6	High	Low	Low	Low
D6	High	Low	Low	High
D6/D4	Low	Low	Low	High
D4	Low	Low	Low	Low
D4/D3	Low	High	Low	Low
D3	Low	High	Low	High
D3/D2	High	High	Low	High
D/2	High	High	Low	Low
Illegal	High	High	High	High
Illegal	Low	High	High	High

Figure 4

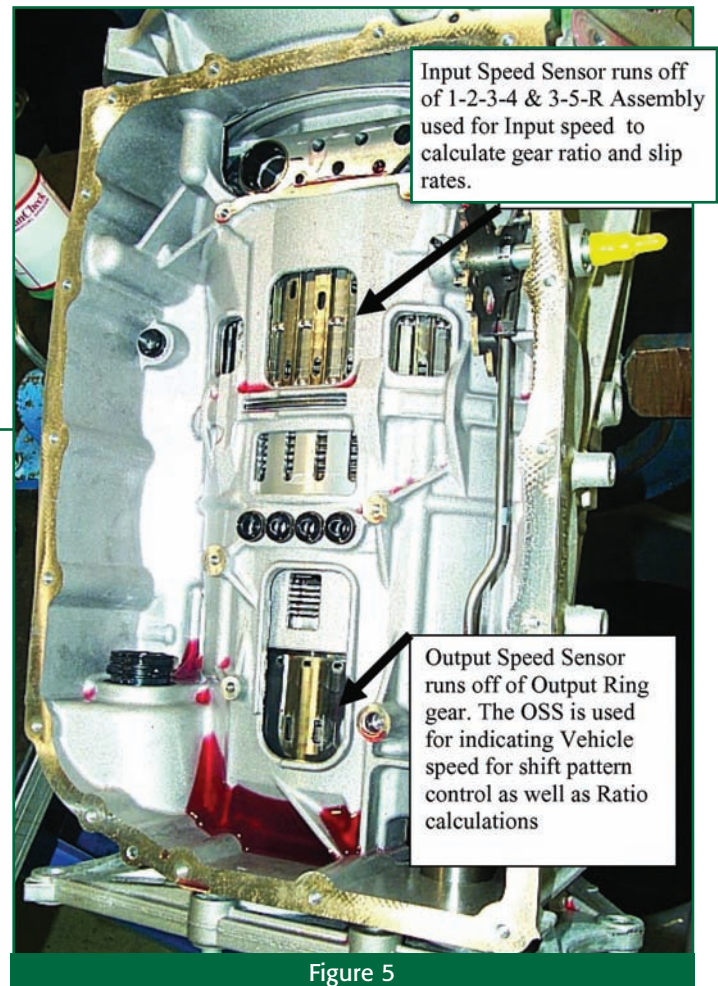


Figure 5

oil pan. The fluid should drip out the level control hole. If so, the fluid level is okay.

- * If fluid doesn't drip from the level control hole, add Dexron VI until fluid starts to drip from the hole.
- * If fluid runs from the hole, wait until the fluid stops running out to lower the fluid to the proper level.

The level is correct when fluid drips from the hole. If a steady stream is present or no flow is present the

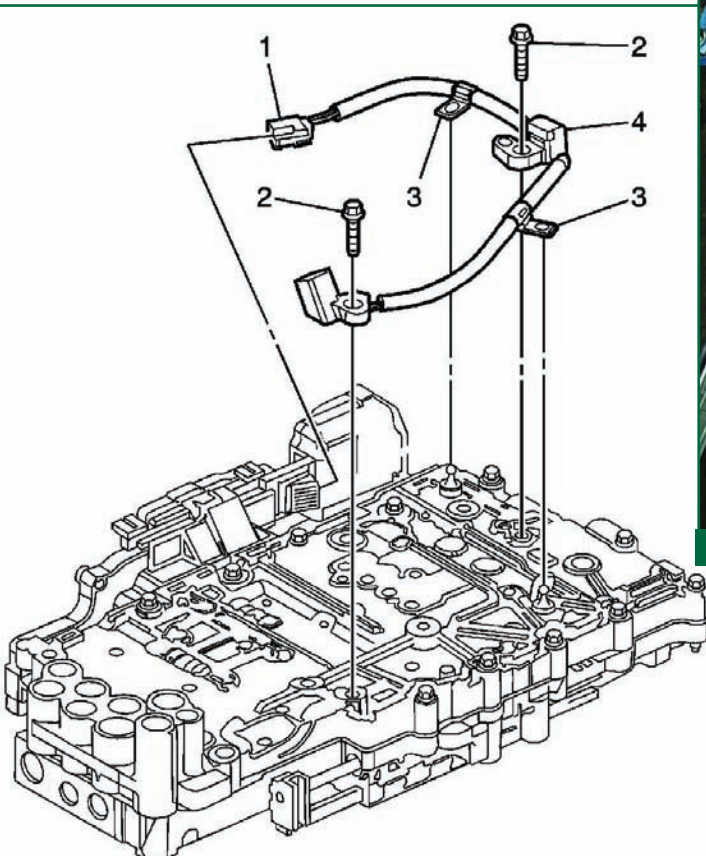


Figure 6





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Metal Sealing Rings	Premium Brands, including GoldStripe®	Non-premium Brands
Rubber Components	Parker	Parker
Aftermarket Fixes	Yes	No
Friction Plates	Raybestos®	Allomatic®

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fluid level is incorrect. Readjust the fluid level, and reinstall the fill plug and the level control plug.

You can add fluid through the dipstick hole or through the level control hole.

What's Inside?

NSBU/PRNDL/IMS Switch
(Figure 3)— The internal mode switch (IMS) is mounted to the valve body and is connected mechanically to the manual valve. Electrically the internal mode switch operates much like other GM applications:

The TCM sends an 8.3–9.3 volt bias to the internal mode switch on 4 circuits: A, B, C and P. Pin N, which is used for neutral starting operations, is fed system voltage from the ECM. As you move the range selector, the internal mode switch will ground or open the circuits or circuit required to indicate the specific manual valve position. The TCM identifies the range by the voltage sequence from the switch (Figure 4).

Low = Grounded (0 Volts)

High = Open (Source Voltage)

Note: Not all applications will include all the ranges shown in the chart

Input and Output Speed Sensors
— The speed sensors are Hall Effect assemblies and are mounted to the control valve assembly (valve body). The TCM provides a signal voltage of 8.3–9.3 volts for the sensor operation. As the clutch housings rotate, the sensors produce a square wave signal that varies frequency with the speed of the clutch housing (Figure 5). The TCM will monitor the frequency of the signal to determine the input or output speed (Figure 6 & 7).

Control Solenoid Body and TCM Assembly (TEHCM)

— The control solenoid valve assembly consists of these components:

- 2 shift solenoids (On/Off design): SS1, SS2; 16-20 ohms at 70°F (21°C)

- 6 controlled pressure control solenoids; PCS, PCS2, PCS3, PCS4, PCS5 and TCC; 3.0-5.5 ohms at 70°F (21°C), 0.9-amp current limit, solenoid operational voltage from TCM 8.3–9.3 volts, cleaning pulse every 30 seconds during P/N.
- 32-bit TCM (TEHCM); mounted inside the transmission on the valve body. Thermal protected 290°F (144°C), default 3rd or 5th.
- 4 pressure switches that monitor valve and clutch hydraulic operation and clutch volume index (CVI — adaptive learn)
- A transmission fluid temperature sensor (TFT) NTC thermistor.
- 2 TCM internal temperature sensors

TFP Switch	Clutch/circuit Monitored
1	3-5 clutch
3	2-6 clutch
4	1-2-3-4 clutch
5	4-5-6 and L/R Clutch

Figure 8

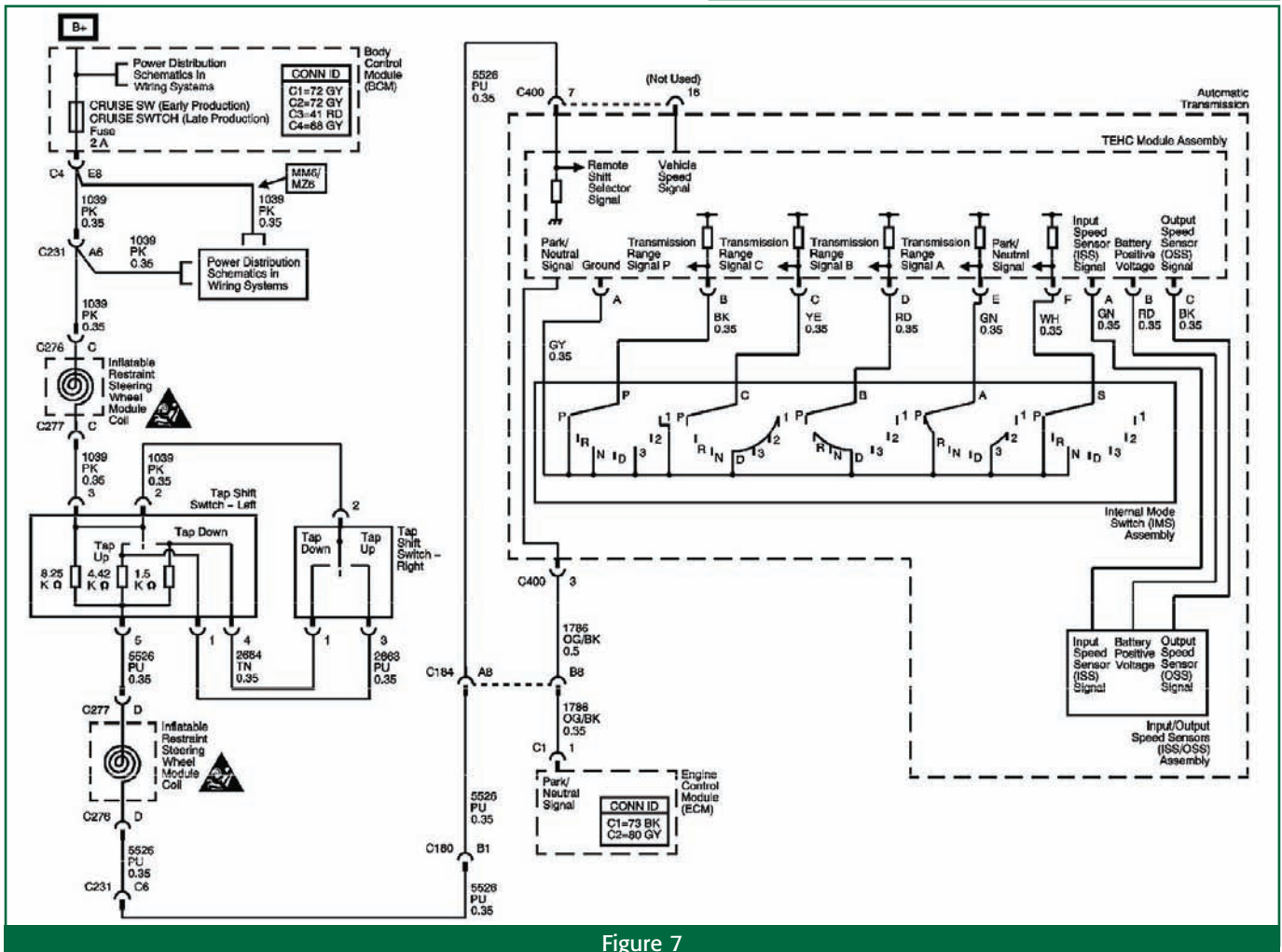


Figure 7

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Pressure Switches — The pressure switches are housed as part of the control solenoid valve assembly. 4 switches are used: 1, 3, 4 and 5. The switches provide an input to the TCM and have two basic functions:

- To monitor clutch regulator valve and clutch hydraulic operation (Figure 8).
- To monitor clutch volume index (CVI — adaptive learning).

Solenoid Operation

IMPORTANT: In systems using the Bosch solenoid system, ON/OFF refers to the solenoids' *hydraulic commanded position*, not their electrical command as with other applications; more on this later.

Shift solenoid and PCS operation is controlled by the TEHCM (TCM). The TCM regulates the feed voltage to the solenoids between 8.3–9.3 volts (Figure 9). The TCM then regulates the current flow through the solenoids. The shift solenoids are On/Off design with the TCM controlling the power and ground for the solenoids (Figure 10). The pressure control solenoids are high-side, PWM controlled. The TCM is overcurrent and overtemperature protected (Figure 11, 12, & 13).

Bosch refers to the solenoids by their hydraulic operation: Normally High (NH) or Normally Low (NL). Normally High means the solenoid *allows* pressure to travel to the clutch when the solenoid is off. Normally Low means the solenoid *prevents* pressure from getting to a clutch when the solenoid is off.

IMPORTANT: This concept of Normally High and Normally Low to describe solenoid operation is far more involved — and confusing — than it might initially appear. We'll discuss the operation of the Bosch solenoids in detail in an upcoming issue of *GEARS*.

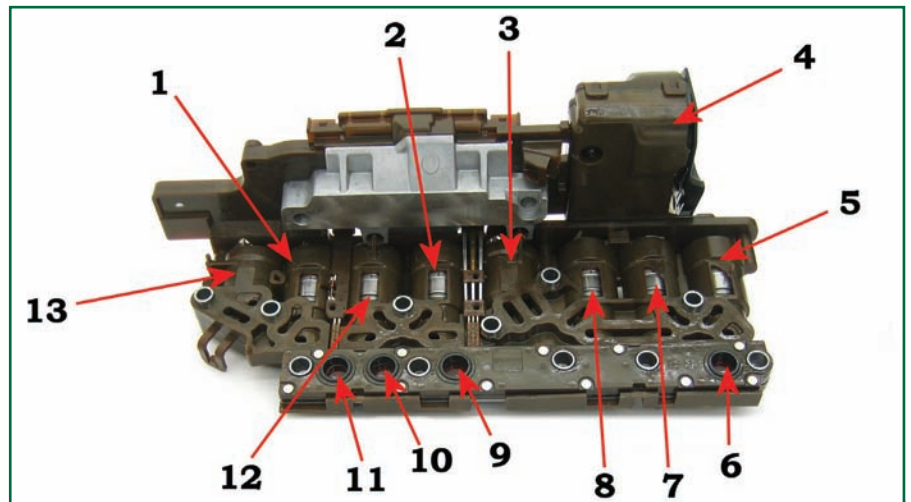
The solenoids are protected by the filter plate. The filter plate is housed between the valve body and the control solenoid valve assembly (TEHCM) and must be replaced any time the valve body or control solenoid valve assembly (TEHCM) is replaced, or are unbolted from each other.

Clutches

The 6L80 transmission (Figure 14)

GEAR	Shift Sol 1	Shift Sol 2	1-2-3-4 Clutch Pres Control Solenoid Solenoid 5	2-6 Clutch Pres Control Solenoid Solenoid 4	3-5 Clutch Pres Control Solenoid Solenoid 2	Low/Rev 4-5-Clutch Pres Control Solenoid Solenoid 3
PARK	ON	ON	OFF	OFF	OFF	ON
REV	ON	OFF	OFF	OFF	ON	ON
NEU	ON	ON	OFF	OFF	OFF	ON
1 st Braking	ON	ON	ON	OFF	OFF	ON
1st	OFF	ON	ON	OFF	OFF	OFF
2nd	OFF	ON	ON	ON	OFF	OFF
3rd	OFF	ON	ON	OFF	ON	OFF
4th	OFF	ON	ON	OFF	OFF	ON
5th	OFF	ON	OFF	OFF	ON	ON
6th	OFF	ON	OFF	ON	OFF	ON

Figure 9



uses three rotating clutches and two stationary clutches.

1-2-3-4/Forward Clutch — This clutch is applied in 1st through 4th gears. The 1-2-3-4/forward clutch is located in the bottom of the reverse clutch housing. When applied, it locks the reverse drum to the 2-6 and 3-5-reverse shell to drive the lower sun gear for the output carrier.

2-6 Clutch — This is one of the stationary clutches. It's located on top of the center support assembly. It prevents the 2-6 and 3-5-reverse shell from rotating.

3-5-Reverse Clutch — This clutch is used in 3rd, 5th and reverse. It's located in the reverse clutch housing. When applied, it connects the reverse drum to the 2-6 and 3-5-reverse shell. The clutch then drives the front output sun gear in the output carrier.

4-5-6/Input Clutch — This clutch is located in the input housing. When applied, it locks the input housing to the 4-5-6 drive hub, which drives the lower output carrier.

Low/Reverse Clutch — This sta-

- (1) Line Pressure Control (PC) Solenoid
- (2) Torque Converter Clutch (TCC) Pressure Control (PC) Solenoid
- (3) Shift Solenoid (SS) 2
- (4) 16 Pin Connector
- (5) Pressure Control (PC) Solenoid 3
- (6) Transmission Fluid Pressure (TFP) Switch 5
- (7) Pressure Control (PC) Solenoid 4
- (8) Pressure Control (PC) Solenoid 2
- (9) Transmission Fluid Pressure (TFP) Switch 3
- (10) Transmission Fluid Pressure (TFP) Switch 1
- (11) Transmission Fluid Pressure (TFP) Switch 4
- (12) Pressure Control (PC) Solenoid 5
- (13) Shift Solenoid (SS) 1

Figure 10

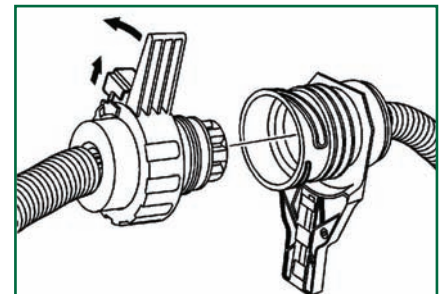


Figure 11

tionary clutch is located in the lower section of the center support. The Low/Reverse clutch is used in reverse and manual low.



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Powerflow

First Gear: 1-2-3-4/Forward clutch (rotating clutch) is applied.

Engine torque is applied to the input shaft, which is the driving component for all ranges. When the input shaft rotates, it drives the input ring gear. The clutch drives the pinions of the input carrier, which is splined to the reverse drum.

When the 1-2-3-4/Forward clutch applies, it transfers engine torque through the input shaft to the reverse drum. The torque then transfers to the 1-2-3-4/input shell. The input shell is splined to the lower output sun gear. The sun gear drives the output carrier pinions, rotating the output ring gear at a 4.027:1 gear ratio.

Second Gear: 1-2-3-4/Forward clutch (rotating clutch) and 2-6 (stationary) are applied.

With the 2-6 clutch applied, the 2-6 and 3-5-reverse shell can't rotate. With the shell locked to the case, the upper output sun gear is held. Engine torque is still being applied through the 1-2-3-4/Forward clutch, which drives the lower sun gear. The combination of the two gearsets provides a 2.364:1 gear ratio.

Third Gear: 1-2-3-4/Forward clutch (rotating clutch) and 3-5-Reverse clutches (rotating clutch) are applied.

With the 3-5-Reverse clutch applied, the reverse drum is locked to the 2-6 and 3-5-Reverse shell. Engine torque is now transferred through both sun shells, driving the output sun gears and output carrier. The pinions rotate, turning the output ring gear at a 1.532:1 ratio.

4th Gear: 1-2-3-4/Forward clutch (rotating clutch) and 4-5-6/Input clutches (rotating clutch) are applied.

With the 4-5-6/Input clutch applied, the hub is driven at engine speed. The 1-2-3-4/Forward clutch is still applied, rotating the lower output sun gear, which rotates the ring gear at a 1.152:1 ratio.

5th Gear: 4-5-6/Input (rotating clutch) and 3-5-Reverse clutches (rotating clutch) are applied.

The 1-2-3-4/Forward clutch releases. The 3-5-Reverse clutch is now applied, driving the upper sun gear in the output gearset. At the same time, engine torque travels through the 4-5-6/Input hub, driving the carrier, which

creates an overdrive ratio of 0.852:1.

6th Gear: 4-5-6/Input (rotating clutch) and 2-6 clutches (stationary) are applied.

With only the 4-5-6/input clutch applied, all of the engine torque travels through the output carrier with an overdrive ratio of 0.667:1.

Reverse: 3-5-Reverse (rotating clutch) and Low/Reverse clutches (stationary) are applied.

With the 3-5-Reverse clutch applied, engine torque from the input shaft is sent through the input gear set, through the reverse drum, to the 2-6 and 3-5-Reverse sun shell. The upper sun gear rotates the pinions. The carrier attempts to rotate, but the Low/Reverse clutch is also applied, holding the carrier stationary. This causes the ring gear to rotate backward at a 3.064:1 ratio.

That's enough for this issue; in the next issue of *GEARS*, we'll look at some of the diagnostic processes for these units.

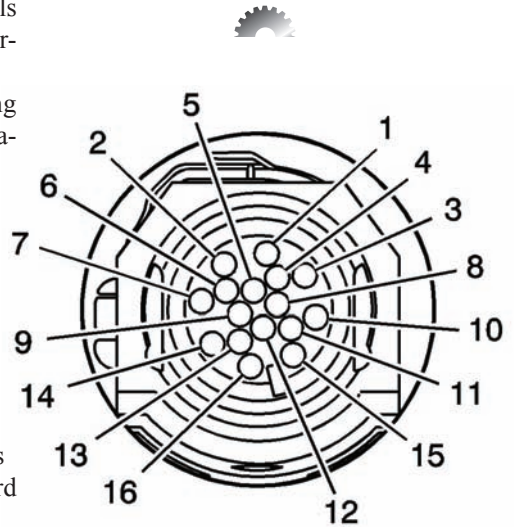


Figure 12

Pin	Wire Color	Circuit No.	Function
1-2	--	--	Not Used
3	OG/BK	1786	Park/Neutral Signal
4	RD/WH	2440	Battery Positive Voltage
5	BK/WH	451	Ground
6	WH	17	Brake Pedal Apply
7	PU	5526	Tap Up/Tap Down
8	--	--	Not Used
9	YE	43	Accessory Voltage
10	TN/BK	2500	CAN Hi
11	TN	2501	CAN Lo
12	PK	1339	Run/Crank Voltage
13	TN	2501	CAN Lo 2
14	TN/BK	2500	CAN Hi 2
15-16	--	--	Not Used

Figure 13

COMPONENT	PARK NEUTRAL	REV	1 ST BRK	1 ST	2 ND	3 RD	4 TH	5 TH	6 TH
1-2-3-4 CLUTCH			ON	ON	ON	ON	ON		
3-5 REV CLUTCH		ON				ON		ON	
4-5-6 CLUTCH							ON	ON	ON
LOW/REV CLUTCH	ON	ON	ON						
2-6 CLUTCH					ON				ON
LOW SPRAG			ON	ON					

Figure 14

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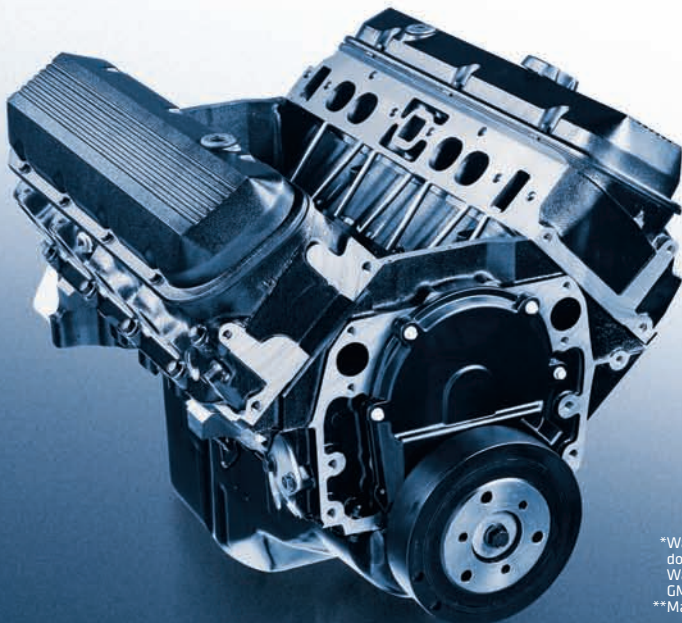
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