



# Technical Service Information

## **THM 4T60-E PRELIMINARY INFORMATION**

The THM 4T60-E is a fully automatic, electronic controlled, four speed front wheel drive transaxle. The 4T60-E was first introduced for the 1991 model year, and is currently found in Cadillac Eldorado, Seville, Deville, Limosines. Also found in Buick Riveria, Park Avenue, Electra, and Reatta - Oldsmobile Toronado, Olds "98" - and will be introduced into Chevrolet "W" cars in mid 1991. It will eventually replace all 4T60 (440-T4) transaxles, with complete change over expected by 1993.

The 4T60-E operation is very similar to the 4T60 (440-T4) operation, with a few minor changes. The 4T60-E has added a 1-2 roller clutch that holds in 1st and 2nd gears, and a 2-1 manual band that is applied in manual D2 and Lo-1st ranges only. The new roller clutch allows the Forward Band (Formerly 1-2 Band) to remain applied in all forward gears. This change eliminates all of the timing problems that were encountered on the 3-2 downshift in the 4T60 (440-T4). The 4T60-E transaxle has a very smooth forced 3-2 downshift. The 2-1 manual band is applied in the D2 and Lo-1st ranges to prevent the 1-2 roller clutch from over-running, and thus provides engine braking in these ranges. Refer to the power flow chart in Figure 1. With the exception of these changes, the mechanical operation is identical to the 4T60 (440-T4) transaxle, so don't let this unit scare you because of the electronic controls.

The 4T60-E transaxle incorporates electronic controls that use the Powertrain Control Module (PCM) to command shift points, and Torque Converter Clutch (TCC) apply and release. Electrical signals from the Vehicle Speed Sensor (VSS) (The Governor is Eliminated), Throttle Position Sensor (TPS) (TV Cable is Eliminated), Coolant Temperature Sensor (CTS), Vacuum Sensor (VS), Park/Neutral Indicator Switch, and Engine Speed Sensor (RPM) are sent to the PCM. Refer to Figure 4 for location of the various sensors. The PCM uses this information to determine the precise moment to energize or de-energize shift solenoid "A" and shift solenoid "B", located inside the transaxle on the valve body (Figure 41, to shift the transaxle into the appropriate gear. Refer to Figure 1 for shift solenoid ON and OFF pattern. The PCM also determines apply or release of the converter clutch, by controlling the TCC solenoid. This type of control provides consistent and precise shift points that is based on the operating characteristics of the vehicle. Shift Solenoid "A", Shift Solenoid "B", and the TCC Solenoid are all "Normally Open" solenoids, and close off the exhaust when energized. All three are exactly alike and will interchange with one another. These three solenoids no longer have the diode incorporated inside the solenoid. The diodes for the two shift solenoids are located inside the PCM, and the diode for the TCC solenoid is located inside the transaxle wiring harness (See Figure 5). The diodes protect the PCM from voltage spikes.

If the PCM detects a trouble code, the PCM will force the transaxle into 3rd gear (Failsafe) for Chevrolet, Pontiac, Oldsmobile, and Buick models, and 2nd gear for all Cadillac models. Cadillac models go to failsafe 2nd gear to protect the Viscous Converter Clutch (VCC) from overheating and causing damage. If for any reason the entire electronic control system to the transaxle becomes disabled (Example: Unplugged or Blown Fuse), both shift solenoids will be OFF and the transaxle will be in failsafe 3rd gear on "ALL" models including Cadillac. This operating state of the shift solenoids permits the transaxle to operate in



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3rd gear only, providing the selector lever is in the Overdrive or D3 range. However, if the selector lever is moved to the D2 Manual Second Range (With Solenoids Disabled) the 2-3 shift valve is "Hydraulically" forced to move, and the transaxle can now operate in the selected gear range regardless of solenoid state.

In Manual 1st gear however, the gear selection is completely electronic for safety and durability reasons. This means that the PCM must electronically command the shift solenoids to be in first gear state in order for Manual 1st gear operation to be achieved.

Notice also that there is a fourth solenoid on the valve body called a Pulse Width Modulated (PWM) Solenoid (See Figure 4). The PWM solenoid receives a ground signal from the Powertrain Control Module (PCM). This ground signal is pulse with modulated (Variable), depending on throttle opening (TPS), and controls the amount of line pressure sent to the back side of the TCC Regulator Valve and thus control converter clutch apply "Feel". This provides for accurate control of the actual value of regulated converter apply pressure. For failure mode considerations the PWM is normally open. This means that when the PWM solenoid is OFF (*No Voltage*), the PWM supply port is open to the PWM output port. This results in a maximum TCC apply pressure when the PWM is OFF. In the unlikely event that the PWM has failed, or is disconnected, and the TCC enable solenoid is still operated, the TCC/VCC will be applied with maximum pressure.

The Pulse Width Modulated (PWM) solenoid "WILL NOT" be used on Chevrolet engine models (See Figure 3). so they will use the normal TCC accumulator system that is in the current 4T60 (440-T4). Currently, Chevrolet engine models are the only ones scheduled to use the old TCC accumulator system. All other models will use the PWM solenoid system. We have also included wiring schematics for the two different systems. See Figure 2 for Buick and Cadillac models, and Figure 3 for the Chevrolet models.

The hydraulic controls have been greatly simplified in the 4T60-E, as the total number of valves have been reduced from 28 to 14. This was accomplished through the elimination of "Several" valve line-ups to control the very sensitive 2-3-1-2 band to clutch sequencing, as this is now controlled with the new 1-2 roller clutch. With the elimination of the complete governor system, and the complete T.V. system, the valve body complexity was further reduced. There was a 2-3 accumulator added to the hydraulic system. We no longer have a 1-2 servo to release on the 2-3 shift, and this was used as a 2-3 accumulator in the 4T60 (440-T4).

Line pressure is still controlled with a vacuum modulator (Old Reliable), but changes are already in the making, as the 4T60-E is scheduled to get an electronic controlled pressure system, with the addition of a "Force Motor" (Pressure Control Solenoid) sometime in 1992.

Everything considered, it looks like we may finally have a "World Class" transaxle on our hands.

## 4T60-E (F-31) POWER FLOW CHART

	INPUT CLUTCH	SECOND CLUTCH	THIRD CLUTCH	FOURTH CLUTCH	FORWARD BAND	D-2 BAND	REVERSE BAND	INPUT SPRAG	1-2 ROLLER	3RD ROLLER
PARK	*							*		
D4/1ST	ON				ON			HOLD	HOLD	
D4/2ND	ON	ON			ON			O/R	HOLD	
D4/3RD		ON	ON		ON				O/R	HOLD
D4/4TH		ON	ON	ON	ON					O/R
D3/1ST	ON				ON			HOLD	HOLD	
D3/2ND	ON	ON			ON			O/R	HOLD	
D3/3RD	ON	ON	ON		ON				O/R	HOLD
D2/1ST	ON				ON	ON		HOLD	HOLD	
D2/2ND	ON	ON			ON	ON		O/R	HOLD	
LO/1ST	ON		ON		ON	ON		HOLD	HOLD	HOLD
REVERSE	ON						ON	HOLD		

\* APPLIED BUT NOT EFFECTIVE

## 4T60-E (F-31) SOLENOID PATTERN

SHIFT SOLENOID

SHIFT SOLENOID

"A"

"B"

1ST GEAR

ON

ON

2ND GEAR

OFF

ON

3RD GEAR

OFF

OFF

4TH GEAR

ON

OFF

### TCC APPLY SOLENOID

THIS SOLENOID CONTROLS THE POSITION OF THE  
CONVERTER CLUTCH APPLY VALVE

### TCC PWM SOLENOID

THIS SOLENOID CONTROLS  
CONVERTER CLUTCH APPLY FEEL

Figure 1

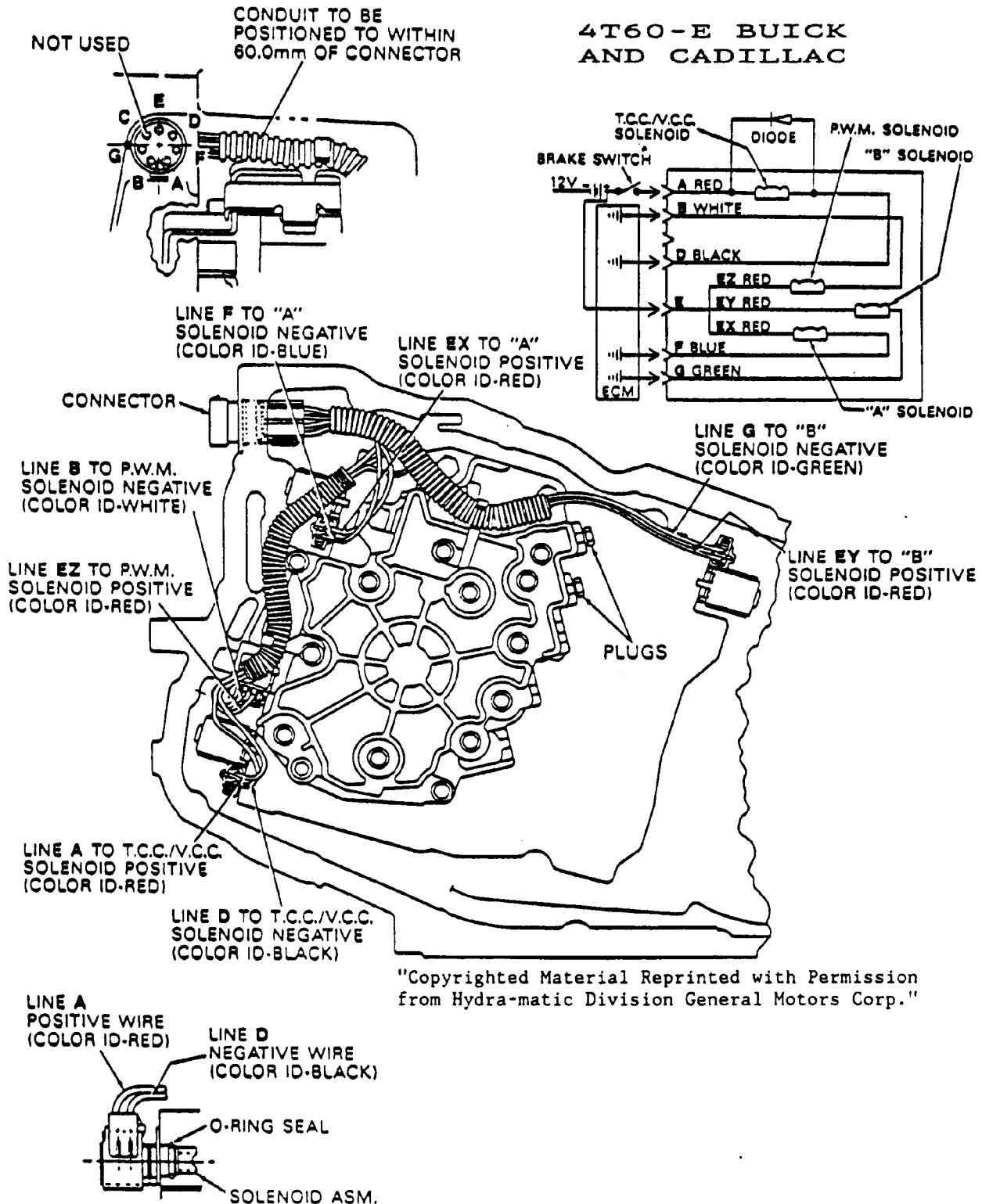
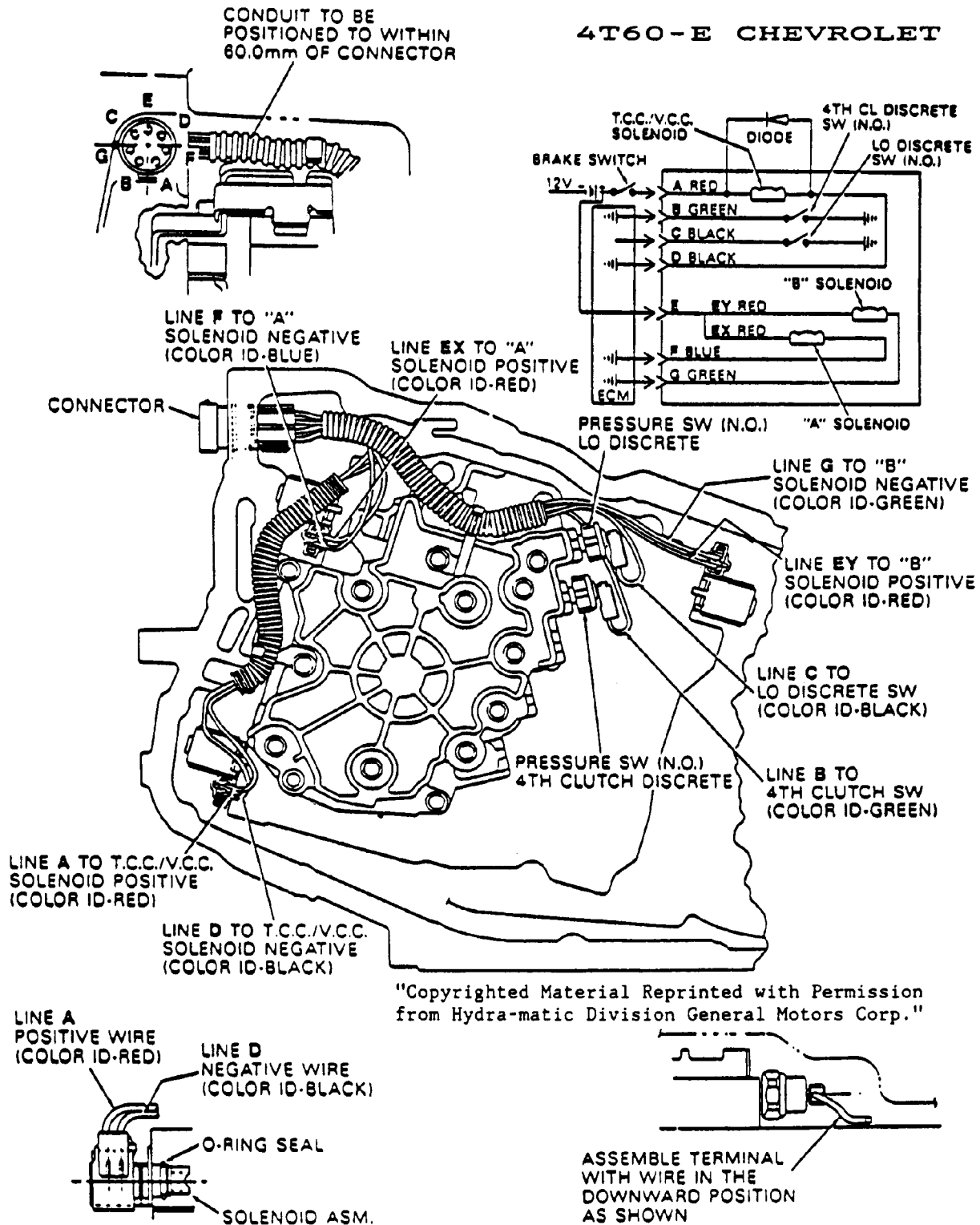
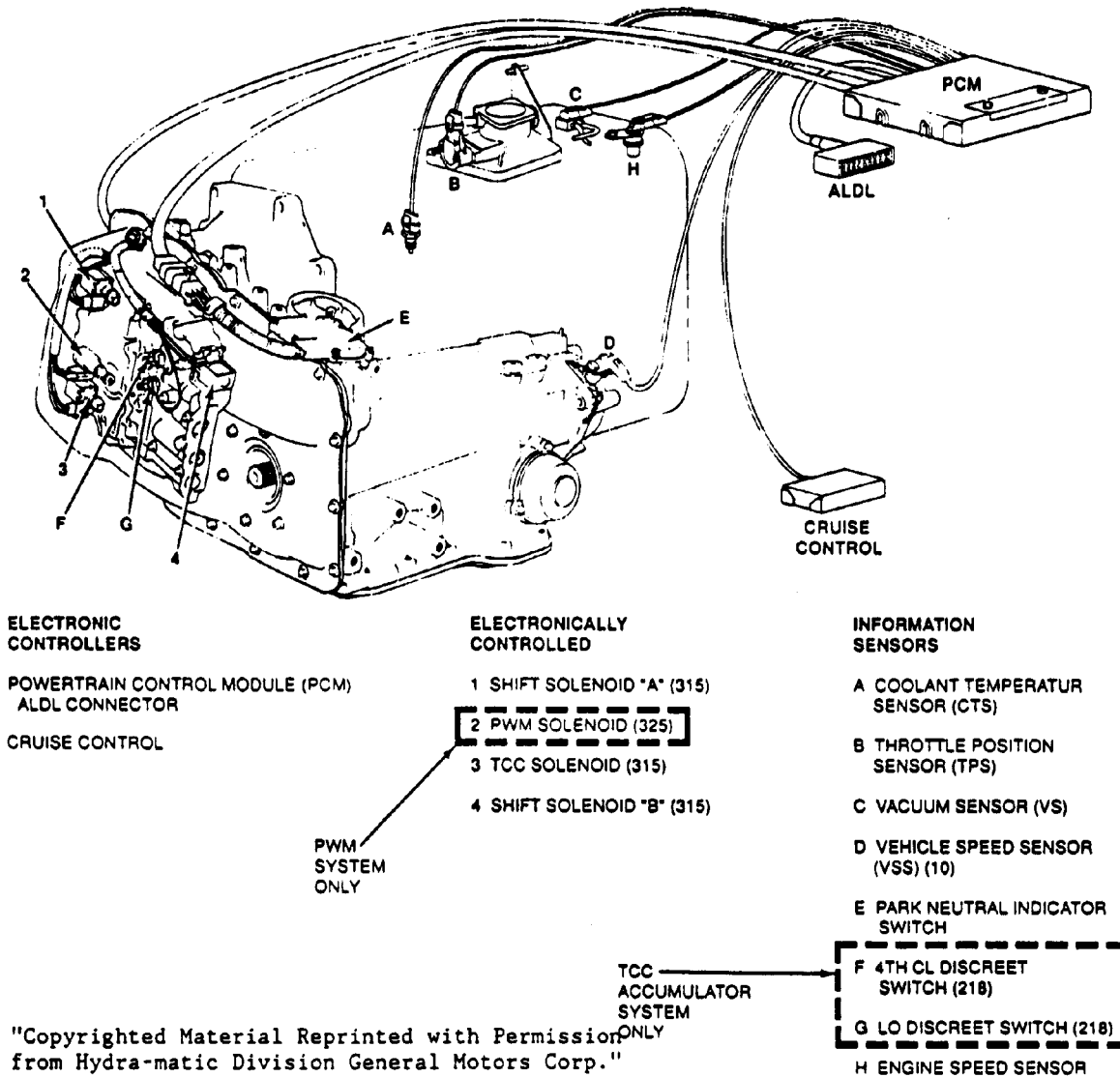


Figure 2

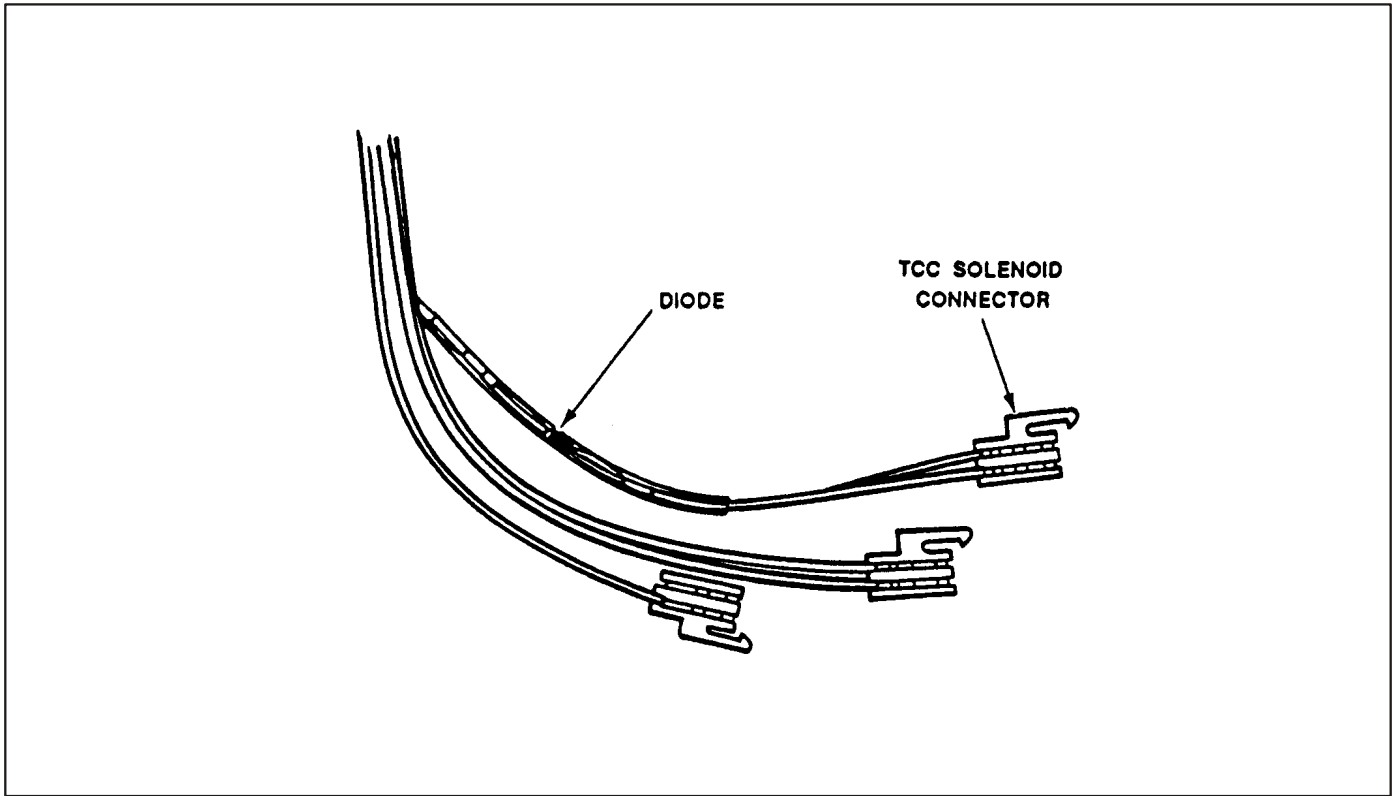


**Figure 3**



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Figure 4



**Figure 5**