



# Technical Service Information

## 2008 - 2010 CHEVROLET MALIBU HYBRID 2008 - 2009 SATURN AURA GREEN LINE HYBRID SYSTEM INFORMATION

The Chevy Malibu Hybrid and the Saturn Aura Green Line both share the exact same hybrid system components. They are both gasoline-electric vehicles that use a 36 volt electrical system and a conventional 12 volt electrical system.

Both vehicles are equipped with a 2.4 Liter four cylinder gasoline engine and a conventional 12 volt starter that is used for initial start up only.

A 36 volt three phase 5000 Watt starter/generator is used to start the engine when the engine is in Auto-Stop Mode and to provide engine assist when under way, this unit is mounted on the right side of the engine and replaces the standard alternator used on the conventional Malibu and Aura. This system is referred to as a BAS (Belted Alternator Starter) system.

The cables from the 36 volt Nickel Metal Hydride (NiMH) battery pack in the trunk are **BLUE** in color to signify the intermediately high voltage they carry. During operation of the hybrid system these cables can carry up to 42 volts of electricity.

The 4T45E four speed front drive transaxle is very similar to the conventional transmission however there a few significant differences, the hybrid version RPO code is ME7, Figure 1, the conventional 4T45E RPO code is MN5.

The ME7 utilizes an Auxiliary Fluid Pump to supply the necessary line pressure requirements during engine auto-stop mode which is controlled by the Starter/Generator Control Module (SGCM).

The ME7 also uses a different Fluid Pressure switch assembly as well as an additional solenoid to control downshift timing which is controlled by the TCM. These two components creates different fluid passages in the major hydraulic components.

**4T45E HYBRID TRANSAXLE (ME7)**



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Figure 1

## SHIFT QUADRANT POSITIONS (Electronic Range Select)

- P** - Park position locks the front wheels and prevents the vehicle from rolling forward or backward. In this position the “Shift Lock” control is in use causing the driver to have to step on the brake pedal to release the shift lever.
- R** - Reverse position allows the vehicle to be operated in a rearward direction.
- N** - If necessary, the neutral position enables the engine to start and operate without driving the vehicle. This position should be selected to restart the engine while the vehicle is moving.
- D** - In the drive position, the transmission will automatically upshift from first to fourth, and downshift from fourth to first according to the normal shift pattern programmed into the TCM.
- L** - The “L” (Low) position places the vehicle in third gear. This position also activates the driver shift control system. The “TAP” system allows the driver to manually shift gears up or down by using the “TAP” plus or minus switches on the gear shift lever

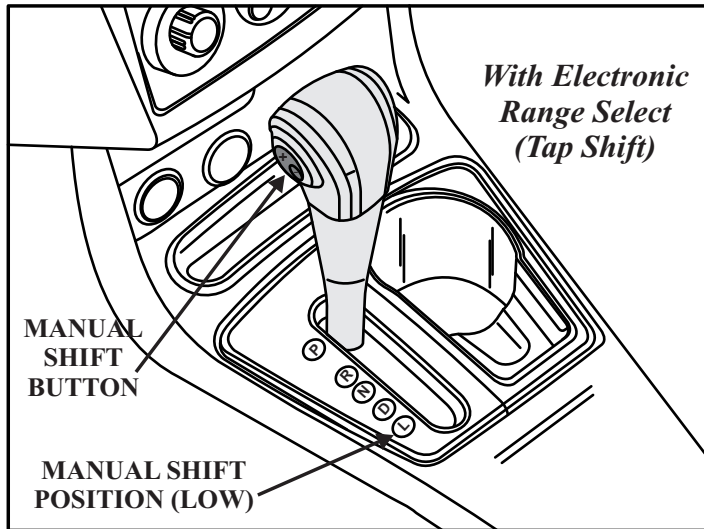


Figure 2

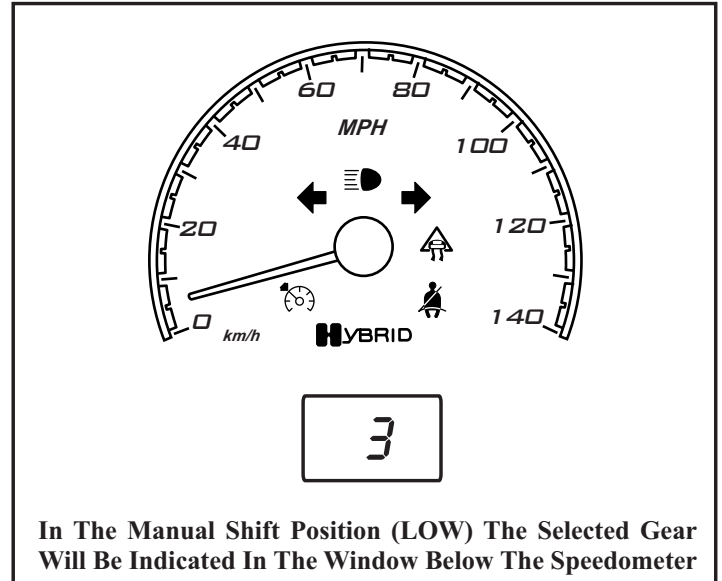


Figure 3

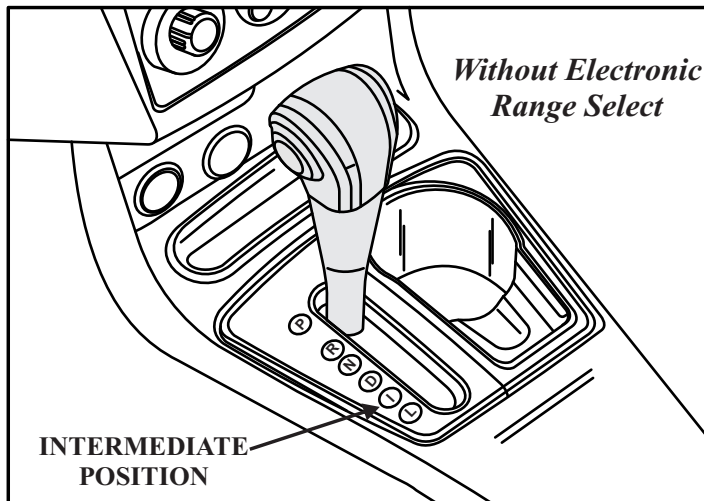


Figure 4

When the vehicle is not equipped with manual shift capability the shift quadrant will have an additional position, it will have Intermediate. The Intermediate position is used when slightly more engine braking is needed. Engine Auto Stop will be disabled in the Intermediate position.

## INSTRUMENT CLUSTER IDENTIFICATION

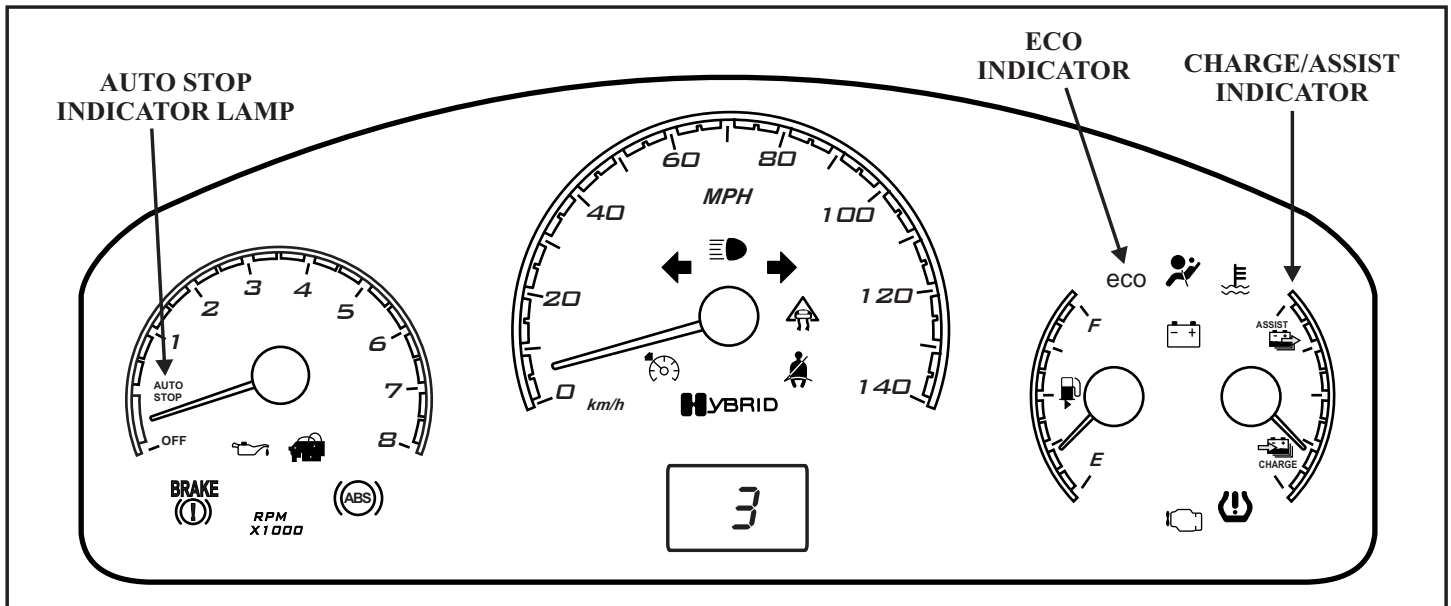


Figure 5

### AUTO STOP:

When the needle is pointing to Auto Stop on the tachometer, Refer to Figure 5 this indicates that the engine is in Auto Stop Mode. When the ignition is turned off the tachometer needle will drop to off, if the drivers door is opened while in Auto Stop Mode a chime will sound.

The Engine Control Module (ECM) will send an Auto Stop state message to the Body Control Module (BCM). The BCM will transmit the Auto Stop message to the instrument cluster.

If all of the following conditions are true the indicated state will be "AVAIL", otherwise the indicated state will be "UNAVAIL".

The Auto Stop ready indication will be a "Driver Information Center" (DIC) message that indicates the following two states:

- 1 - AUTO STOP AVAIL =Auto Stop available.
- 2 - AUTO STOP UNAVAIL =Auto Stop unavailable.

The following criteria must also be met:

- Vehicle speed of 4 miles per hour exceeded.
- Ambient temperature above 5°F (-15°C).
- Hybrid and powertrain component temperatures in hybrid operational ranges.
- Hybrid battery temperature is greater than 50°F (10°C) and less than 122°F (50°C).
- Transmission fluid temperature is greater than 95°F (35°C) with ambient temperature less than 50°F (10°C).
- Transmission fluid temperature is greater than 68°F (20°C).
- Engine coolant temperature is greater than 176°F (80°C) with ambient temperature less than 50°F (10°C).
- Engine coolant temperature is less than 250°F (121°C).
- Vehicle is in drive (No Auto Stop available in other gear shift positions).
- HVAC compressor system request Engine ON.
- Grade less than 18 percent.
- Sufficient brake vacuum.
- State Of Charge (SOC) is greater than required for Auto Stop (70%).
- Battery discharge power capability is greater than minimum required for AutoStart (6200 Watts).

Continued 

## INSTRUMENT CLUSTER IDENTIFICATION

### ***Continued:***

- Acceptable 12 volt battery status, (voltage, current and temperature).
- No wheel slip (ABS or Traction Control) active.
- Evap system is not running a small leak test.
- Hood is closed (Hood Ajar Switch indicates hood is open), Refer to Figure 6.
- Default action 1, 2, 3 or 4 not active.



Figure 6

### **CHARGE/ASSIST GAUGE:**

The Charge/Assist gauge displays the charge (current) into and out of the hybrid battery. When the electric motor is assisting the engine as in maximum acceleration, the needle will move to the ASSIST range. The ASSIST range as shown in Figure 5 shows an arrow pointing to a battery icon. When the electric motor operates as a generator to perform regenerative braking while decelerating, the needle will move to the CHARGE range. The needle will also move into the CHARGE range if the hybrid control system deems it is an efficient time to charge the hybrid battery. The CHARGE range will show an arrow pointing to a battery icon as shown in Figure 5.

If the hybrid battery or other hybrid components are too hot or too cold, the CHARGE and ASSIST functions may be suspended until the component temperatures are normal.

### **ECO INDICATOR:**

The ECO Lamp, Refer to Figure 5 will illuminate when the vehicle is achieving fuel economy close to its rated performance.



## HYBRID BATTERY DISCONNECT PROCEDURE



Figure 7



Figure 8

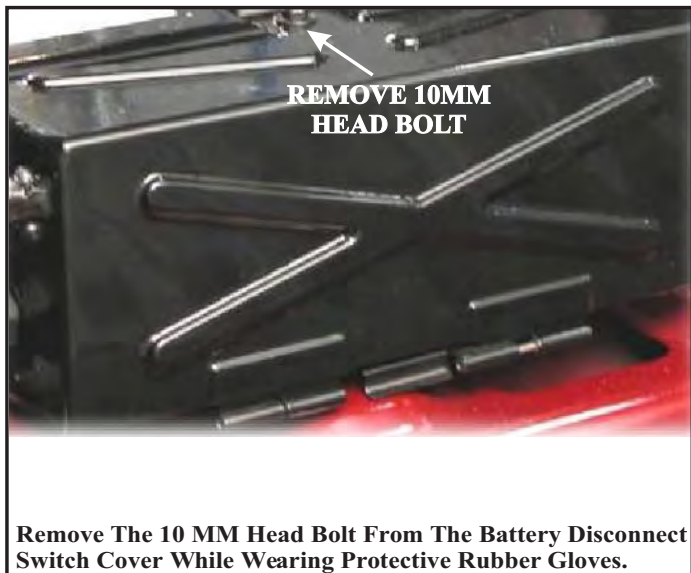


Figure 9

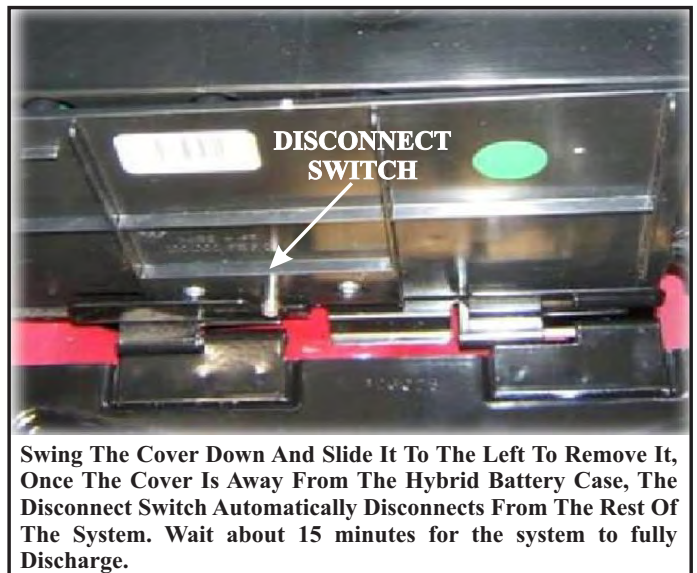


Figure 10



Figure 11

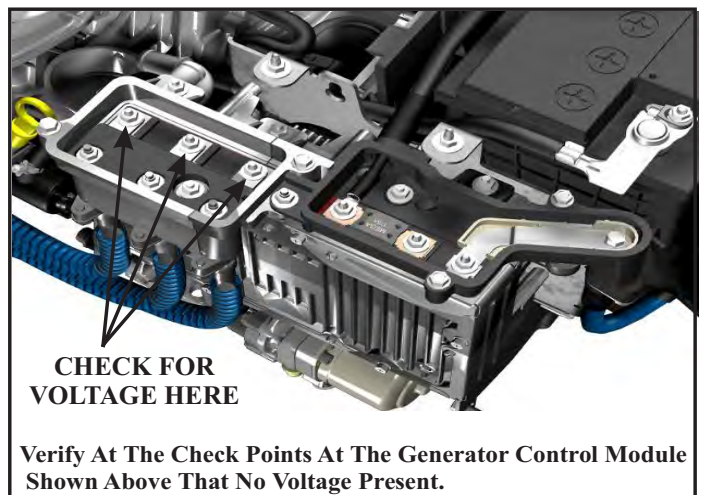


Figure 12

## HYBRID COMPONENTS

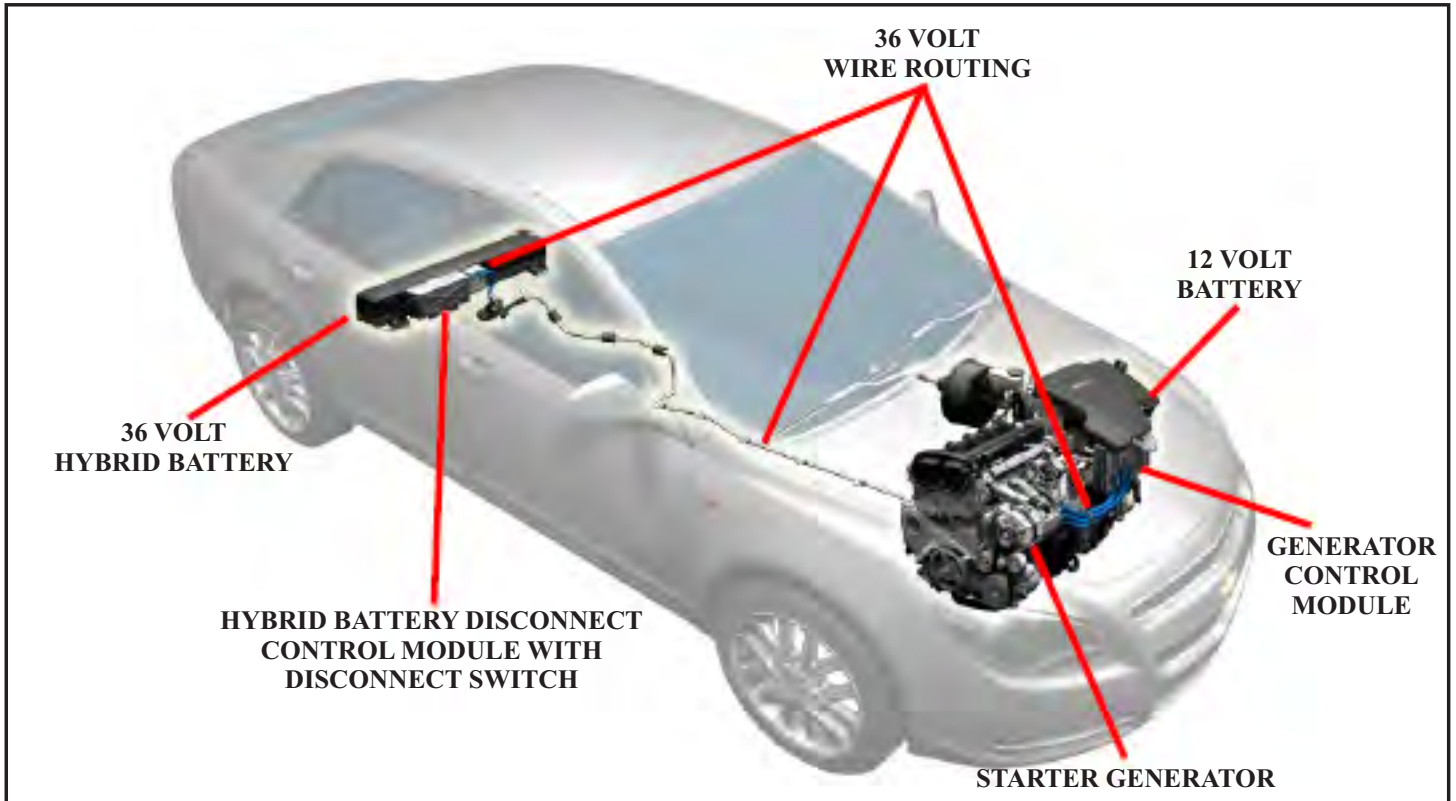


Figure 13

## HYBRID BATTERY PACK

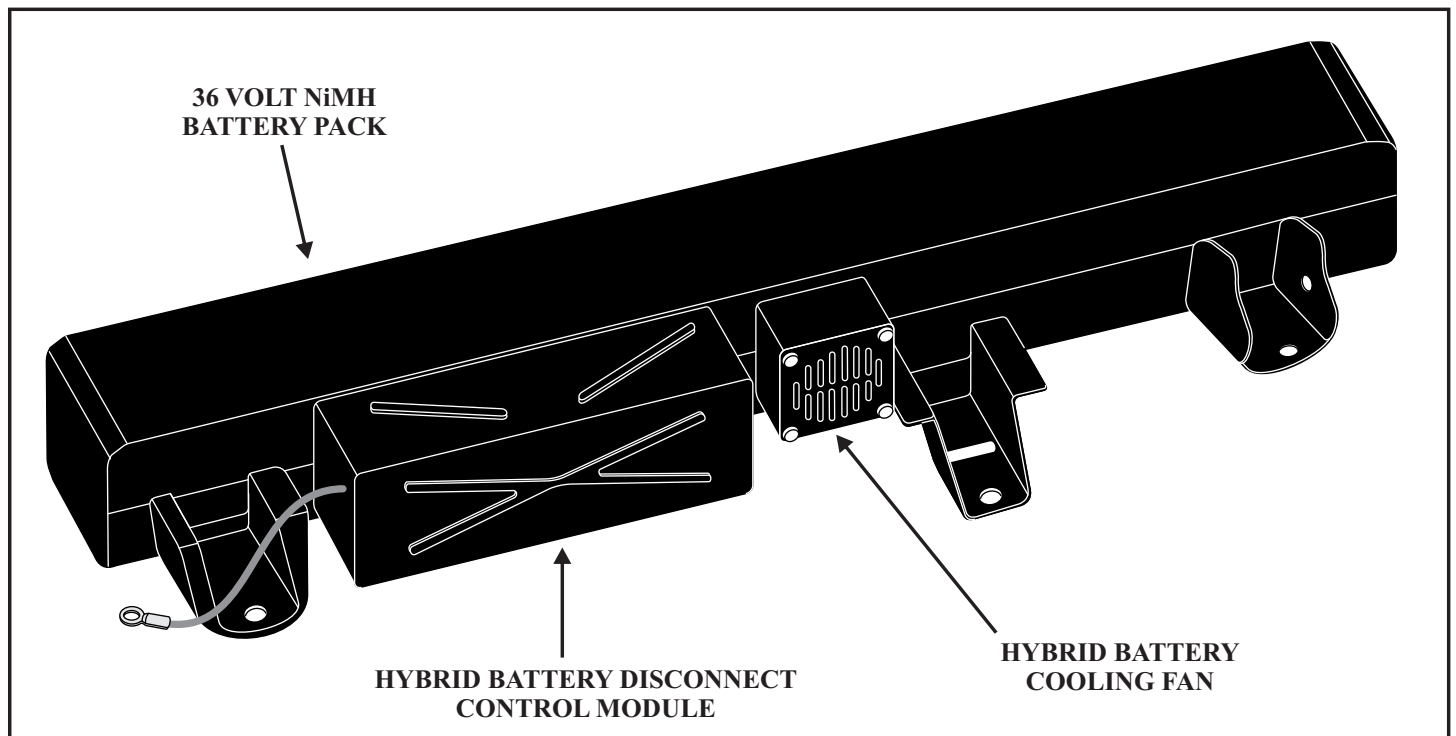


Figure 14



## GENERATOR CONTROL MODULE

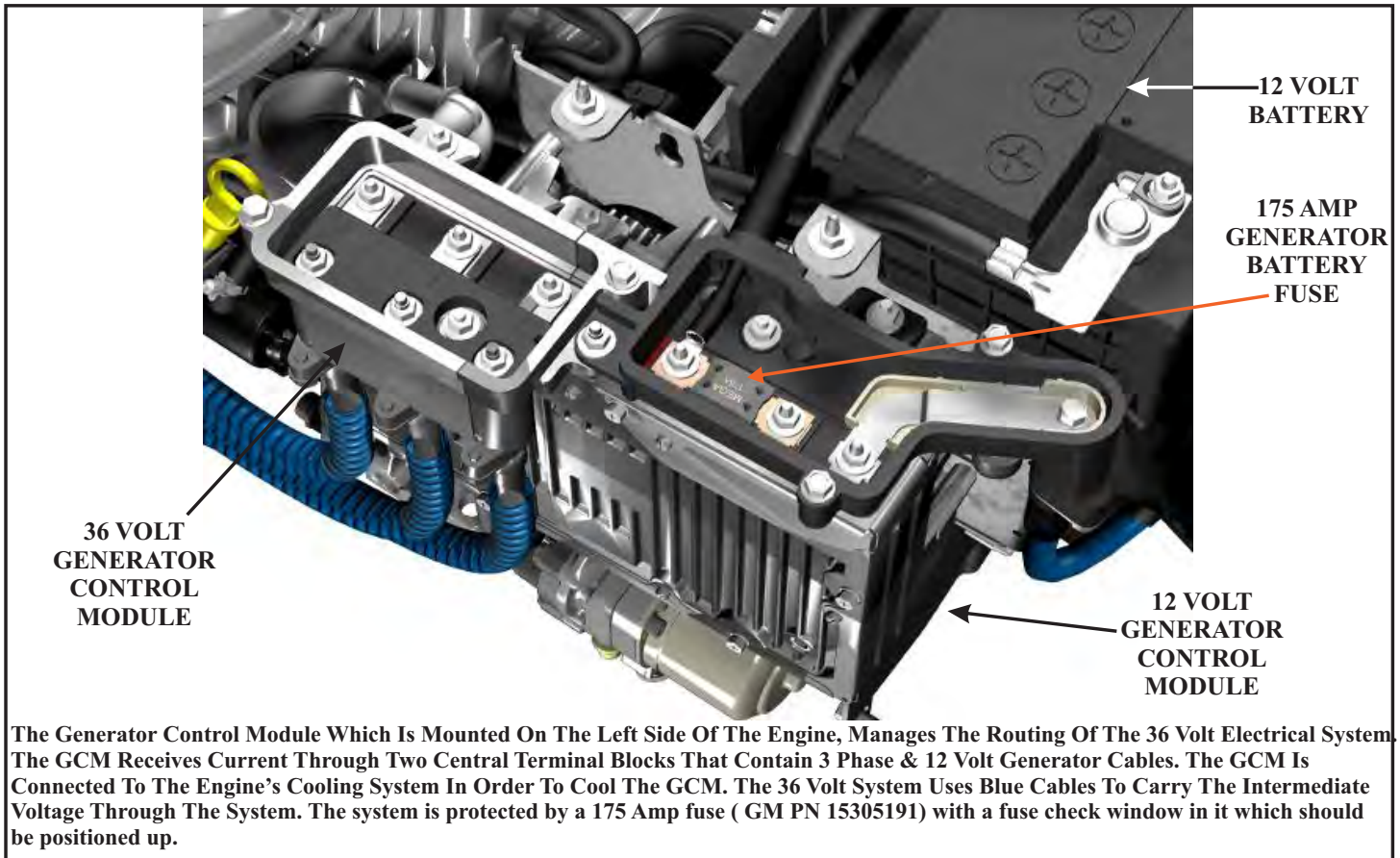


Figure 15

## STARTER GENERATOR

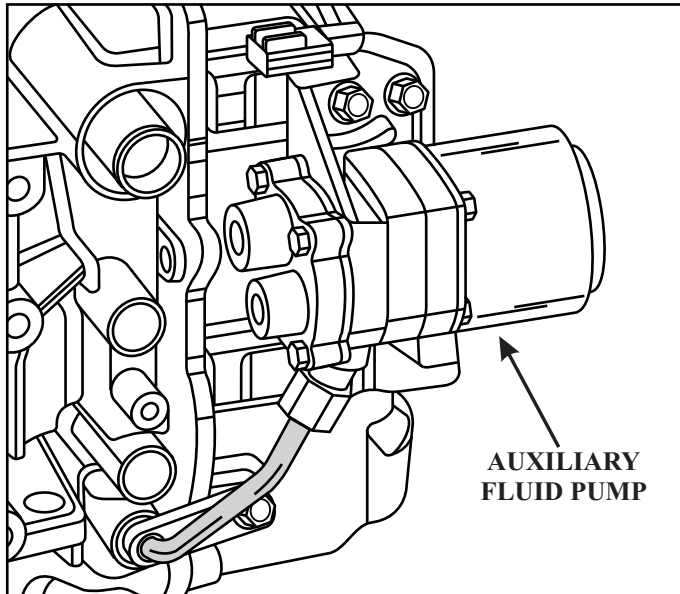


Figure 16



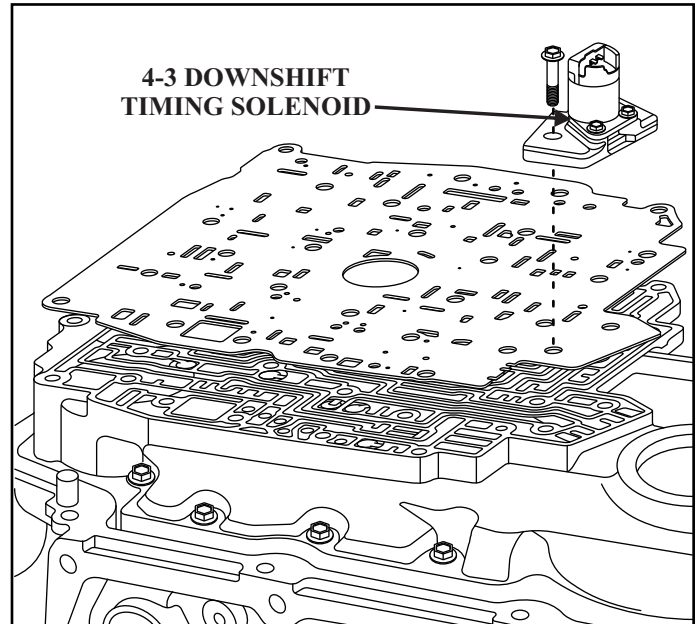
Figure 17

## THE ME7 (4T45E) HYBRID TRANSMISSION



The 4T45E, RPO ME7, Is For The Most Part Conventional With A Few Exceptions. One Exception Is That It Uses A 12 Volt Auxiliary Pump To Maintain Normal Operating Line Pressure When The Engine Is In Auto Stop Mode. The ECM Monitors The Dedicated Fluid Pressure Switch To Insure That The Auxiliary Pump Is Maintaining Proper Line Pressure Levels. The Starter Motor Generator Controls The Auxiliary Pump By Providing A Ground Path For The Pump Relay Control Circuit Therefore Sending Power To The Hybrid Pump Driver (HPD).

Figure 18



The 4-3 Downshift Solenoid Controls Fluid Pressure Acting On The Shift Timing Valve To Position The Shift Valves For The Appropriate Gear. The 4-3 Downshift Solenoid Is A Normally Closed ON/OFF And Is Located On The Channel Plate. The 4-3 Downshift Solenoid Is Controlled By The Transmission Control Module.

Figure 19

### AUXILIARY PUMP PRIMING PROCEDURE

Whenever the fluid is drained from the transmission, the Auxiliary Fluid Pump will require a priming procedure. To begin the procedure the transmission should have no less than 8 quarts of ATF in it.

Using a capable scan tool enter the vehicle information and locate the "Special Functions" menu. Locate the Bi-Directional controls for the auxiliary pump and turn it ON.

Keep the pump running for approximately 30 - 60 seconds, at this time the pump will be primed. Now fill the transmission to its proper operating fluid level.

### FLUID SPECIFICATIONS

Fluid Type - DEXRON® VI	
Service Fill	7.0 Quarts. (6.6 Liters)
Dry Fill	12.9 Quarts (12.2 Liters)



## THE ME7 (4T45E) HYBRID TRANSMISSION TRANSMISSION FLUID PRESSURE SWITCH ASSEMBLY

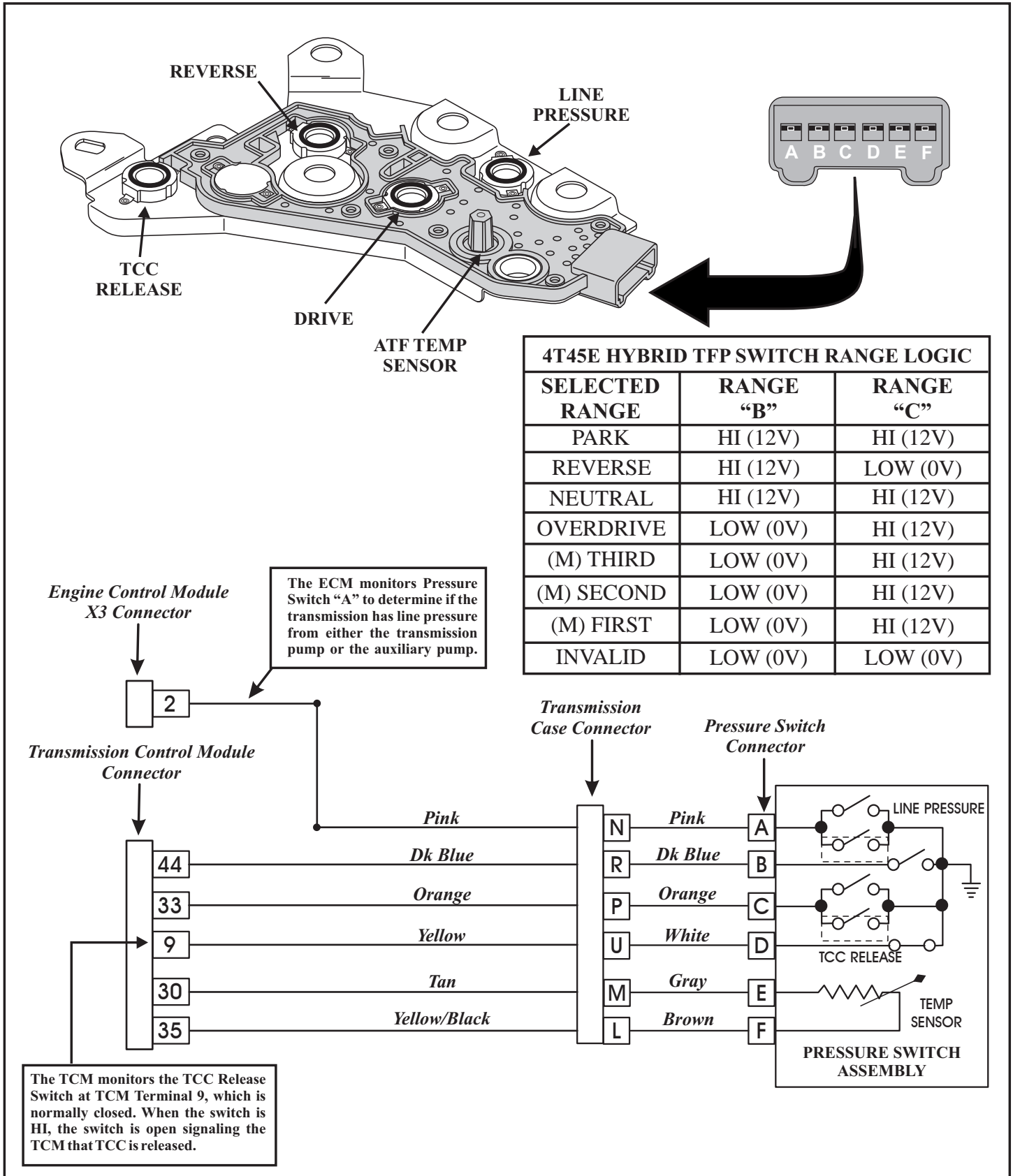


Figure 20