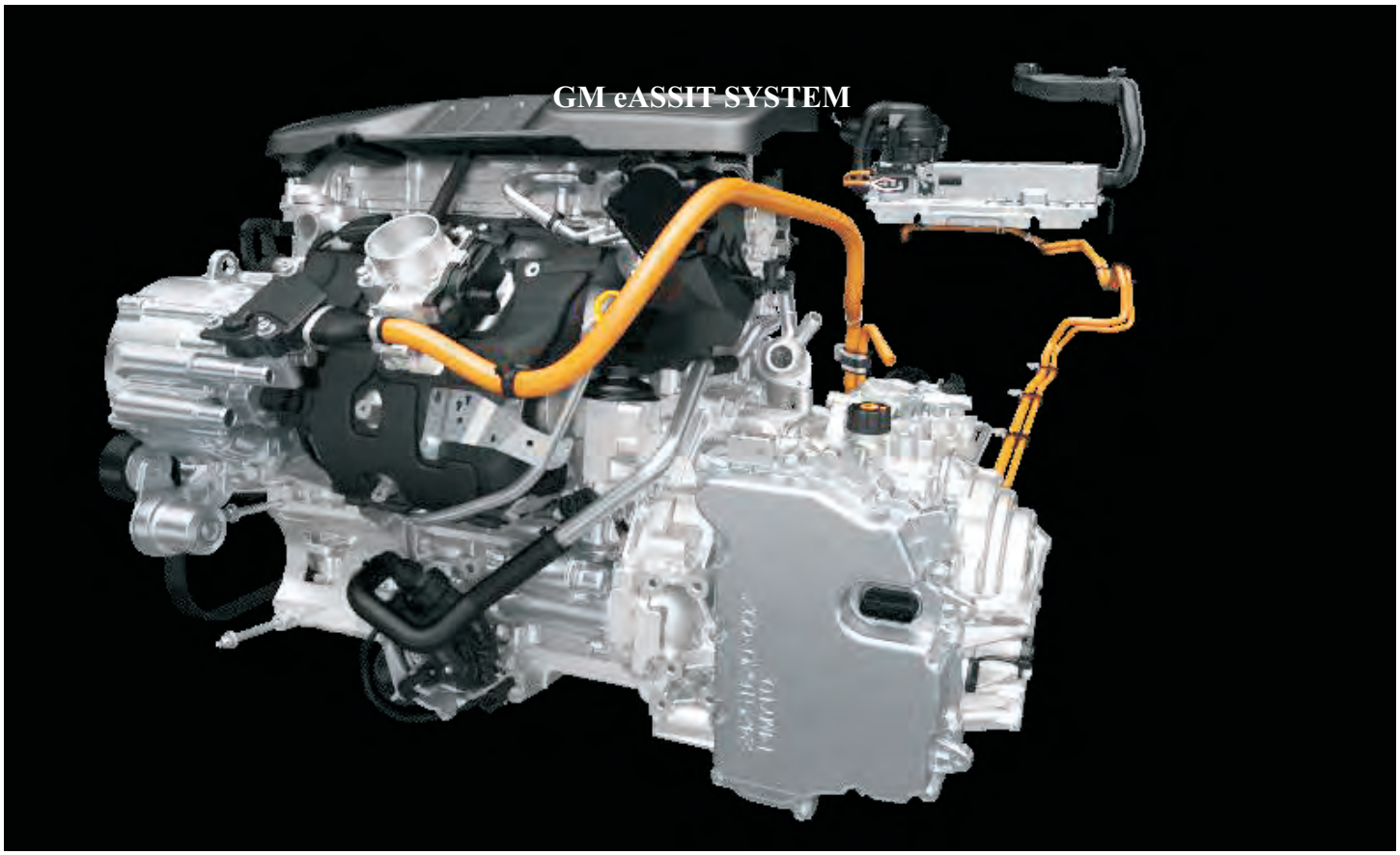
GM eASSIST BAS HYBRID SYSTEM

PRELIMINARY INFORMATION

The GM eAssist Mild Hybrid BAS System is used in 2012 to 2015 Buick LaCrosse and Regal as well as the 2012 to 2014 Chevy Malibu ECO.
The eAssist system uses a 130 Volt Lithium Ion Battery, a 15 kW liquid cooled electric induction motor and also has regenerative braking capability.
The eAssist system uses a 2.4 Liter gas engine for assist and a 6T40 transmission which is equipped with an auxiliary fluid pump to provide transmission operating pressure when Auto-Stop is active during engine shut off at a stop.
These vehicles are also equipped with a Hill-Assist feature which captures brake pressure to help the operator accelerate easier when the engine is in Auto-Stop mode and the vehicle is on a steep grade which helps prevent the vehicle from rolling backwards.
Integrated into the generator control/battery module assembly is a 14 Volt inverter to operate all the low voltage components in the vehicle.
The 6T40 transmission is designed to work with the eAssist system more efficiently using changes to clutch control to reduce spin losses and improved shift response time.
The vehicle underbody is fitted with panels for improved aerodynamics and roll resistant tires to achieve maximum fuel economy.

A special thank you to Martin Smith and John Kelly for the photos used in this information.



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.

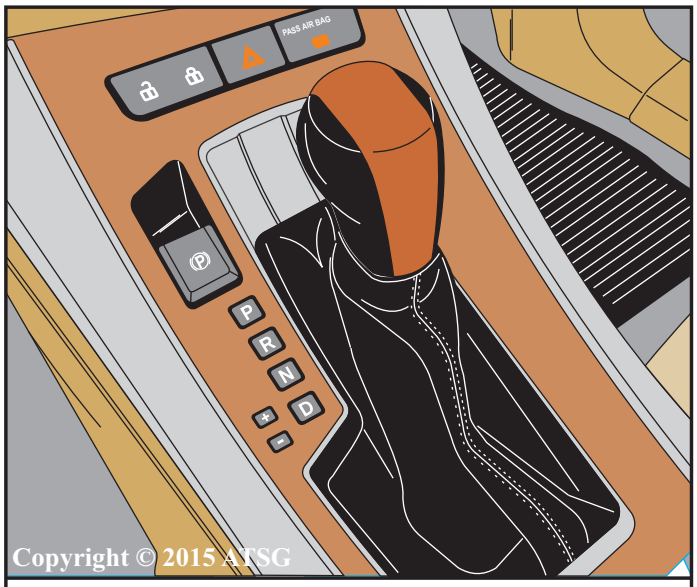
R Reverse position allows the vehicle to be operated in a rearward direction.

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 sixth, and downshift from sixth to first according to the normal shift pattern programmed into the TCM.

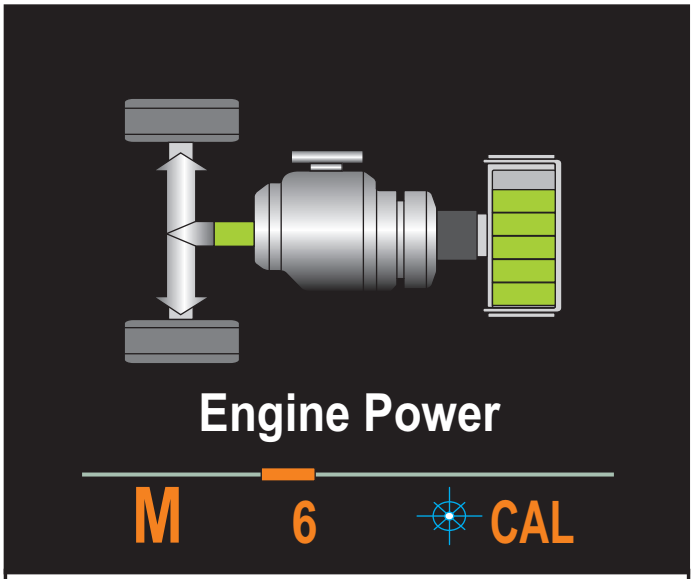
D+/- Moving shift lever from the “D” position to the left activates Driver Shift Control (DSC) which affords the operator manual shift capability. Taping the shifter up or down will provide a higher or lower gear selection. The TCM allows shifting through all six gears appropriate for vehicle speed and engine rpm. The display on the instrument panel will indicate which gear has been selected by displaying an “M” followed by the selected gear number, i.e. “M3” for third gear selection.

NOTE: Depending on make and model year, some vehicles may have an “M” position in the shift quadrant which is the manual shift mode. These vehicles may have a plus/minus button at the top of the shifter or paddle shifters on the steering wheel.



When equipped with Driver Shift Control (DSC), moving the shifter from “D” to the left allows the driver to tap the shifter up (+) or down (-) to manually select gears 1 thru 6.

Figure 1



The instrument cluster will display which gear has been selected manually by displaying an “M”, then the number of the gear selected.

Figure 2

INSTRUMENT CLUSTER IDENTIFICATION

AUTOMATIC ENGINE STOP/START

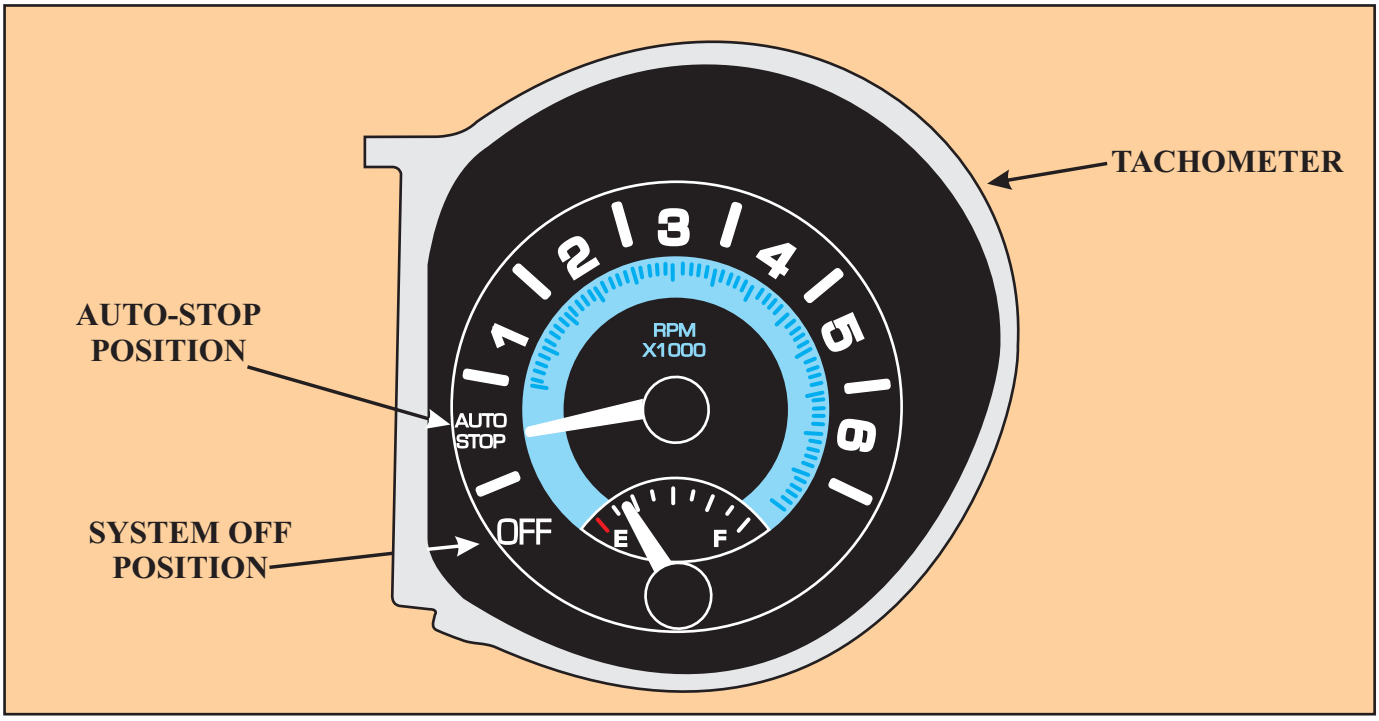


Figure 3

Vehicles equipped with the eAssist System have a feature known as “Auto-Stop” which allows the engine to shut off when the vehicle comes to a stop and to restart after the vehicle has come to a stop. The Auto-Stop indicator is located in the tachometer cluster as seen in the picture above. When the vehicle comes to a stop and the engine shuts off the tach needle will drop to the Auto-Stop position. When the engine restarts the needle will register engine rpm. When the needle points to zero, the system is completely off and the engine will not restart automatically.

The Engine Will Remain Running When:

- The engine, transmission or hybrid battery is not warmed up.
- The outside temperature is less than ° F (-15° C).
- The air conditioning or defrost system requires the A/C compressor to maintain vehicle comfort.
- The shift lever is in any position other than DRIVE.
- The hybrid battery pack is in a low state of charge.
- The 12 volt vehicle battery charge is low or load demand is high.
- The hood ajar switch indicates the hood is not closed.

The Engine Will Restart When:

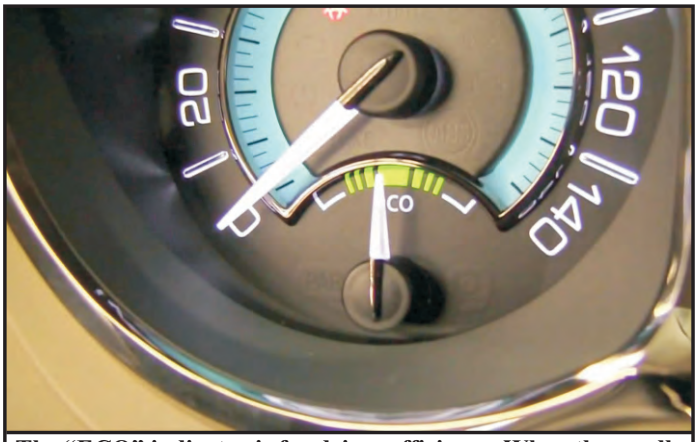
- The brake pedal is released.
- The accelerator pedal is not released.
- Shifting out of DRIVE to any other gear
- If the ECO A/C button has been selected.
- Climate Control demand is high.
- The hybrid battery pack is low and requires recharging.
- Auto-Stop time is longer than two minutes.

HOOD AJAR SWITCH

The "Hood Ajar" Switch signals the Hybrid Powertrain Control Module whether the hood is open or closed in order that the Auxiliary Transmission Fluid Pump will turn on when the engine shuts off. When the hood is ajar the engine will run without automatically stopping. When the hood is closed the Auto-Stop feature returns to normal operation.

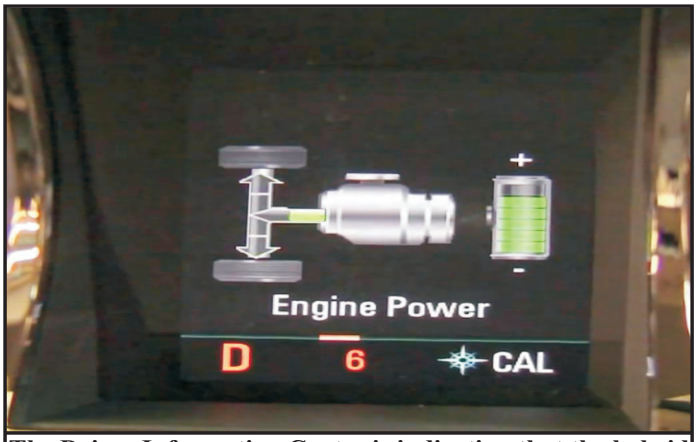
Figure 4

INSTRUMENT CLUSTER IDENTIFICATION



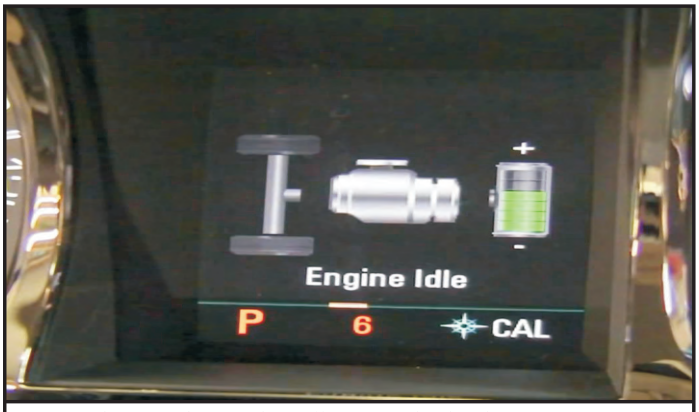
The "ECO" indicator is for driver efficiency. When the needle is in the center green area, maximum fuel milage is realized.

Figure 5



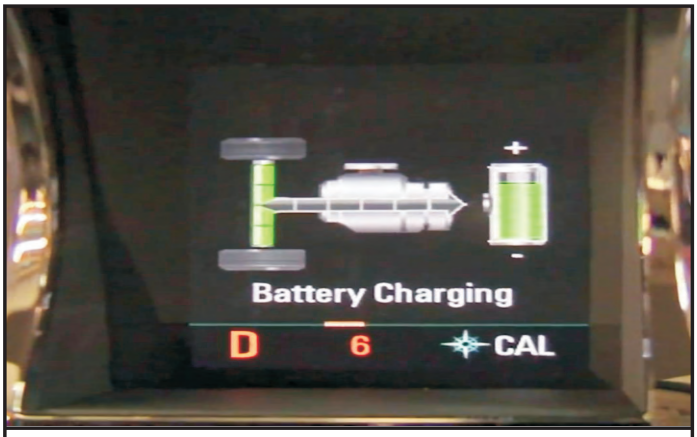
The Driver Information Center is indicating that the hybrid system is receiving engine power for motivation.

Figure 7



The Driver Information Center will indicate the state of operation the vehicle is in as well as hybrid battery state of charge. There is no power transfer at engine idle in park.

Figure 6



The Driver Information Center is indicating regenerative braking is active which recharges the hybrid battery pack.

Figure 8

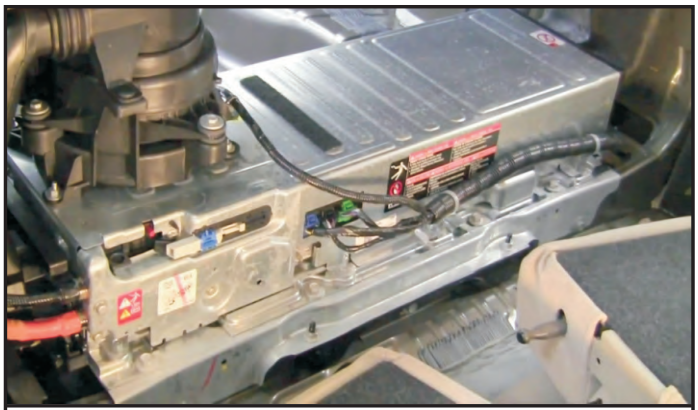
HYBRID BATTERY ACCESS & AIR COOLING SYSTEM

The Lithium Ion Battery Pack is located under a cover. Access to the cover is through the trunk.

Figure 9

To gain access to the hybrid battery/inverter, the rear seat backs will have to be disconnected from their pivot points.

Figure 10

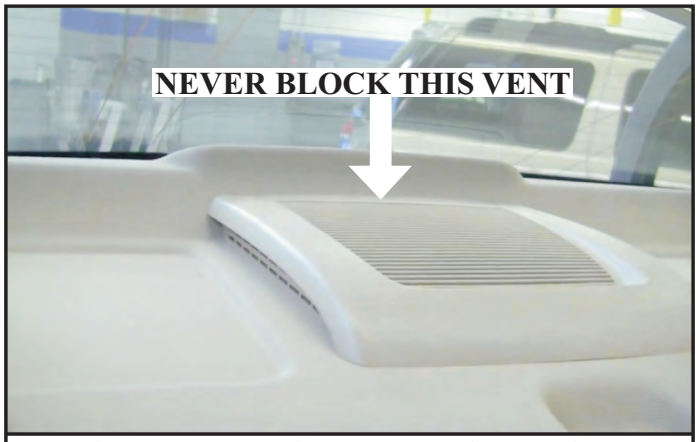


This hybrid assembly contains the battery disconnect switch, the AC to DC & DC to DC Inverter/Converters as well as the hybrid system control modules. This assembly is air cooled.

Figure 11

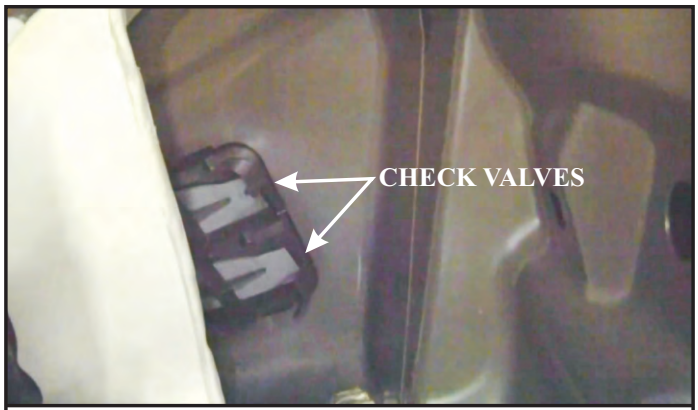
The Hybrid battery box is electrically air cooled by a 12 Volt fan and a complex duct work system which brings in fresh air and exhausts the exiting air out of the vehicle.

Figure 12



Fresh air to cool the hybrid battery pack is drawn in through the vent located on the rear package shelf.

Figure 13



The hybrid battery cooling system duct work ends in the driver side rear wheel well. Built into the body are check valves that let used air out but lets nothing into the vehicle.

Figure 14

HYBRID BATTERY DISCONNECT & RECONNECT PROCEDURE

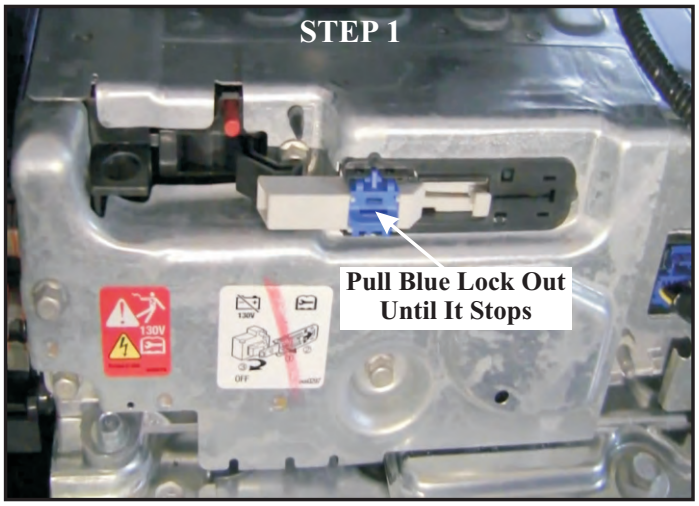


Figure 15

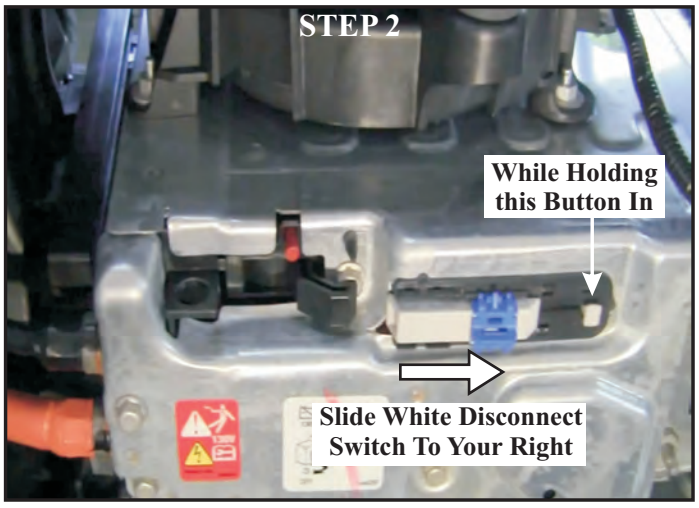


Figure 16

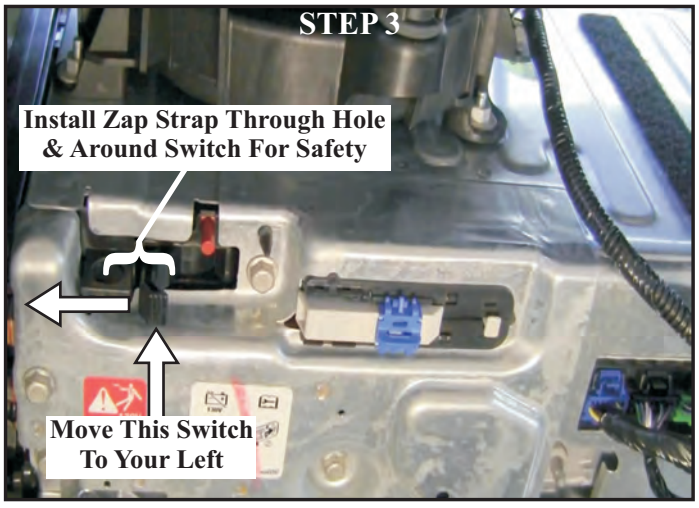


Figure 17

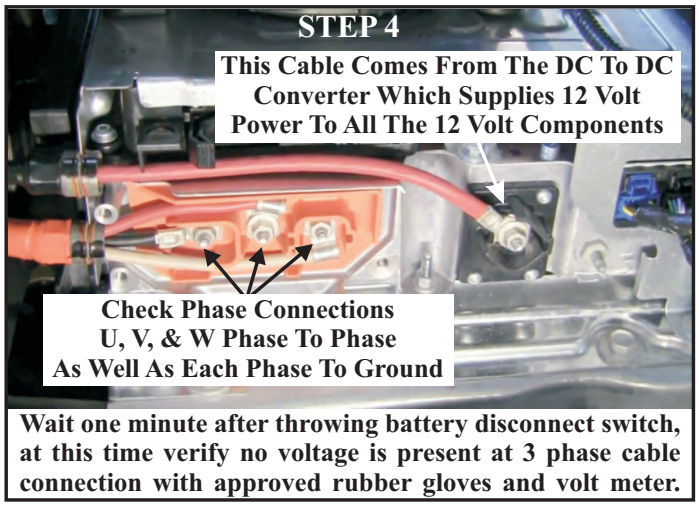


Figure 18

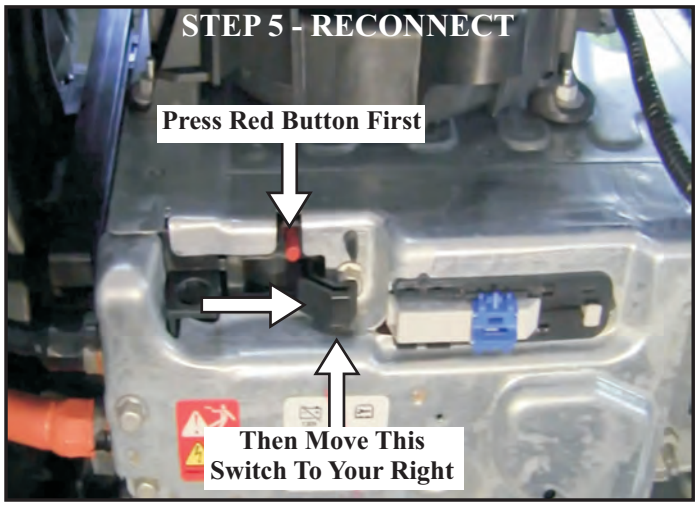


Figure 19

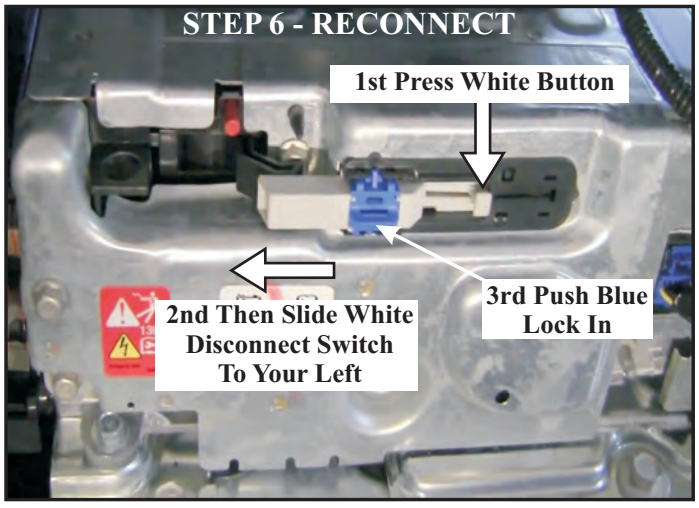
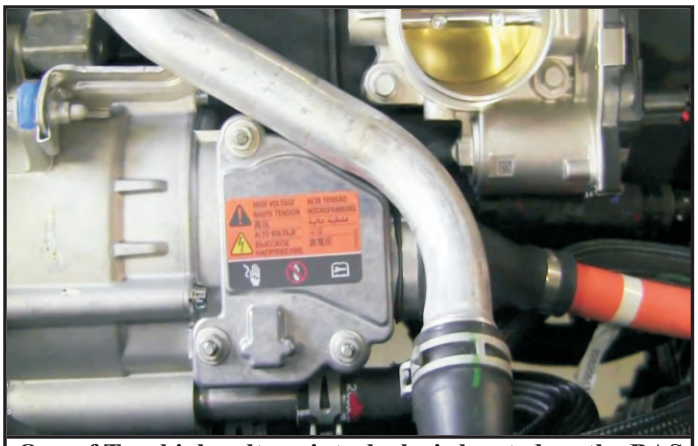
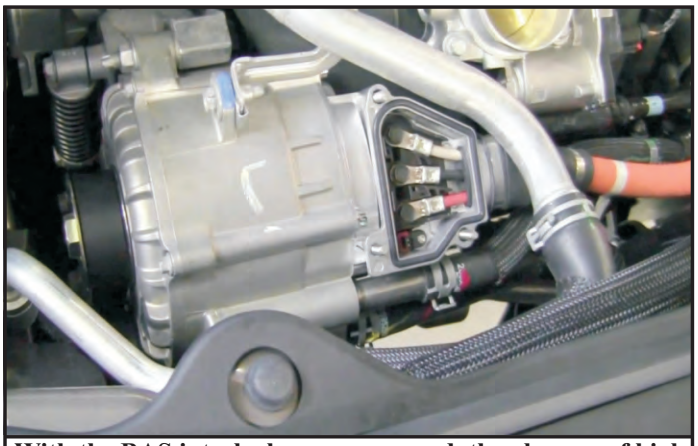


Figure 20



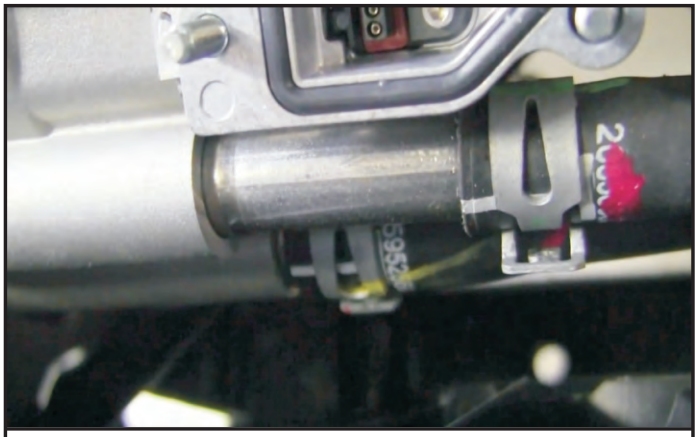
One of Two high voltage interlocks is located on the BAS assembly with the appropriate warning label.

Figure 21



With the BAS interlock cover removed, the absence of high voltage can be verified with approved safety equipment.

Figure 22



The BAS assembly is liquid cooled, the coolant hoses enter at the bottom of the BAS housing.

Figure 23

Mounted on the driver side inner fender is the 12 Volt dedicated BAS coolant pump.

Figure 24

The BAS drive belt tensioner assembly contains an extremely strong damper spring, exercise care when disconnecting it.

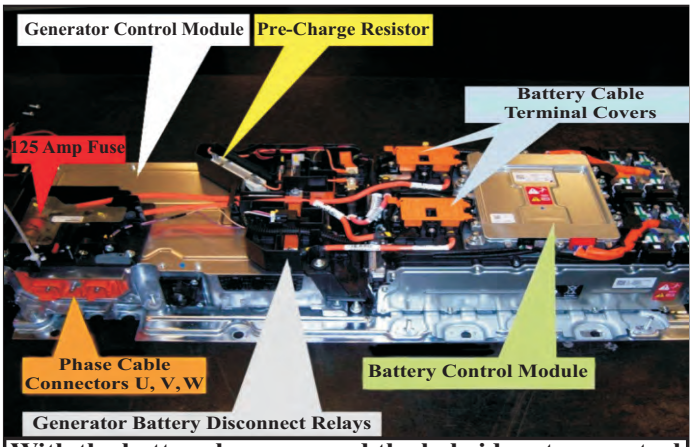
Figure 25

When disconnecting the BAS belt tensioner damper spring, use Kent-Moore Tool #EN-48932 or similar device to avoid injury.

Figure 26

The 12 Volt battery is located in the engine bay on the driver side. Disconnect the cables if working on high voltage circuits.

Figure 27

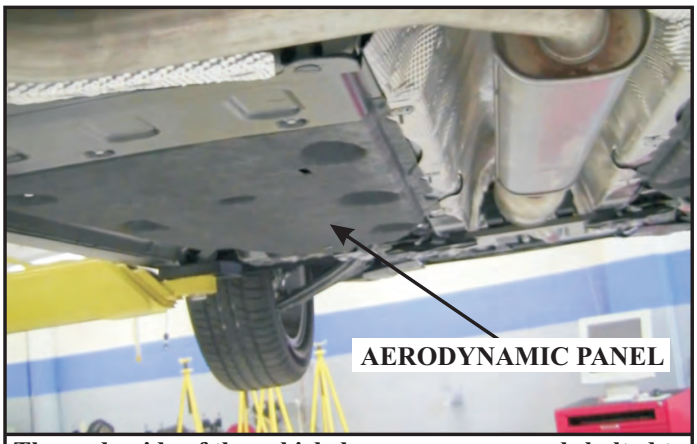


With the battery box removed the hybrid system control components can be identified.

Figure 27

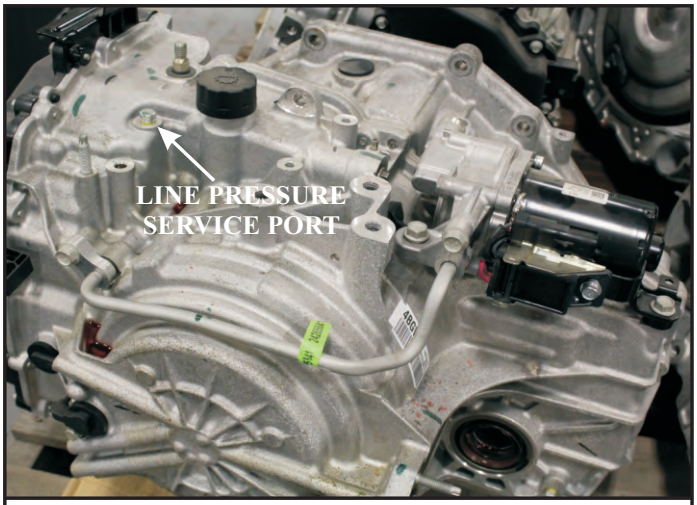
Electrical conduit carries the high voltage cables from the battery box in the rear of the vehicle to the BAS assembly im the front of the vehicle. The conduit is exposed only in a few areas as most of it is concealed behind the under body areo-dynamic panels.

Figure 29



The underside of the vehicle has numerous panels bolted to the body for aero-dynamic purposes.

Figure 30



The eAssist uses a 6T40 transmission with a 12 Volt Auxiliary Pump to supply transmission operating line pressure. The pump will turn on when the engine goes into Auto-Stop Mode. The pump is piped into a main line pressure passage as seen above and has an inline check valve to prevent the engine driven pump pressure from back feeding the auxiliary pump fluid circuit. When checking auxiliary pump pressure, the same service port is used as when checking the engine driven pump pressure. Make certain the auxiliary pump is running, the pressure gauge should register 30 - 40 PSI. The auxiliary pump does NOT have the ability to vary rotational speed, it can only be ON or OFF. A capable scan tool can be used to turn on the auxiliary pump relay. Make certain the scan tool is used to turn the pump off. When the engine starts up normal line pressure values will be seen at the same service port.

Figure 31

6T40/6T45/6T50 SPECIFICATIONS

LINE PRESSURE CONTROL SOLENOID PRESSURE			
REQUESTED PRESSURE		ACTUAL PRESSURE	
PSI	KpA	PSI	KpA
NONE	NONE	50 - 80	345 - 550
30	200	100 - 130	690 - 900
58	400	160 - 190	1100 - 1310
87	600	220 - 250	1520 - 1725
116	800	270 - 330	1860 - 2275
Using a capable scan tool, access the transmission output controls and select the Line Pressure Solenoid. Use the scan tool to increase and decrease the LPC Solenoid in 15 psi (100 kPa) increments in PARK with engine rpm below 1500. This protects the clutch plates from damage due to pressure that is too high or low.			

Figure 32

TRANSMISSION FLUID CAPACITY SPECIFICATIONS		
APPLICATION	SPECIFICATION	
	QUARTS	LITERS
Fluid Change - Approximate Capacity	4.2 - 6.3	4.0 - 6.0
Valve Body Cover Removal - Approximate Capacity	5.3 - 7.4	5.0 - 7.0
Overhaul - Approximate Capacity	8.5 - 9.0	8.0 - 8.5
The transmission fluid level must be checked when the transmission fluid reaches a temperature of 185 - 203º F (85 - 95º C). Adjusting the fluid level outside these temperatures will result in internal damage (underfilled) or fluid discharge out of the vent (overfilled)or possible overheating of the transmission.		

Figure 33