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Technical Information For The Collision Industry

FORD ESCAPE HYBRID

Until recently, there have only been a handful of gasoline-electric hybrid vehicles for collision repair technicians to be aware of. As interest in decreasing environmentally harmful emissions and improving fuel economy rises, vehicle makers will be producing more of these energy saving vehicles. This spring, repair technicians have another gasoline-electric hybrid vehicle to watch for; the 2005 Ford Escape hybrid, which is now available to consumers.

Performing repairs on gasoline-electric hybrid vehicles presents collision repair technicians with some very specific concerns. The primary concern may be working safely on or around the high voltage system. An initial difficulty that technicians could encounter may simply be recognizing the vehicle as a hybrid model. Most hybrid models have an outward appearance similar to their traditional counterparts.

APPEARANCE

The Escape hybrid model looks similar to the traditional Escape model with a few differences. The hybrid model features a "road-and-leaf hybrid" insignia on the lift gate, front doors, and on the acoustic engine cover (see Figure 1).

Another unique feature is an air intake for the high voltage battery. Ford Motor Company states that this air vent is an unobtrusive integrated ductwork for the battery temperature-management system. This system is located in the left

side rear quarter panel window and is distributed along the side panel (see Figure 2).

If it is not possible to identify an Escape as a hybrid because of the extent of damage, technicians can use the VIN as a determining factor. Escape hybrids have a U95 (FWD model) or U96 (4WD model) in the 5th, 6th, and 7th position of the VIN. Non gasoline-electric hybrids have U92, 3, or 4 (FWD models) or U02, 3, or 4 (4WD models) in those positions.

POWERTRAIN

The Escape hybrid is a full hybrid, meaning it has the capability to automatically switch between electric motor power, gasoline engine power, or a combination of the two. Together, the 2.3-liter four-cylinder gasoline engine and the 65-kW electric traction motor provide a combined output of 155 horsepower. The Escape hybrid is available with a four-wheel-drive option.

ELECTRICAL POWER

As with other gasoline-electric hybrid vehicles, the Escape hybrid never requires plugging into an electrical outlet. The generator motor starts the engine, recharges the batteries, and provides power boosts during heavy load situations.

Energy is reclaimed during braking to help charge the 330-volt nickel-metal-



Figure 1—The "Road and Leaf" insignia identifies a Ford Escape hybrid.

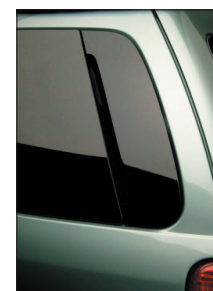


Figure 2—This is the high voltage battery temperature management air intake.

hydride high voltage storage battery. This feature, known as regenerative braking, is also common with other hybrid vehicles. The high voltage storage battery is located beneath the rear load floor (see Figure 3). The high voltage battery pack consists of 250 D-sized cells in a sealed enclosure. All high voltage wires and harnesses are wrapped in orange-colored insulation.

The Escape hybrid also has a conventional 12-volt battery to power lights and electrical accessories. The 12-volt battery is located under the hood of the vehicle.

The Escape hybrid is equipped with features to help provide safe access when working on them. To disable the high voltage electrical system, use as many of the following steps as possible:

- Put the shift lever in "Park." Remove the ignition key. Removing the ignition key or turning it to the OFF position should disconnect the high voltage system.
- Disconnect the negative cable from the 12-volt battery. Doing this should also disconnect the high voltage system.
- To ensure the high voltage system is disabled, remove the High Voltage Service Disconnect Switch located on the top, passenger side, of the high voltage battery.

Damaged or malfunctioning parts could affect the success these steps. Be aware that the individual cells inside the high voltage battery will still be charged. Always wear class 0 linesman gloves when working around these high voltage systems.

Technicians should also be aware of the regenerative braking when moving these vehicles, which could restore energy to some parts. Moving a hybrid vehicle with the drive wheels on the ground may gen-

erate electrical energy and charge the condensers in the inverter.

INTERIOR

Escape hybrids are equipped with a battery indicator dial that indicates if the high voltage battery is powering the electric motor or if it is being charged while braking or cruising. An optional system features an energy flow diagram that displays hybrid system operation and a fuel economy screen that displays instant and average fuel economy.

The Escape hybrid interior may also feature a 110-volt accessory electrical outlet located in the center console (see Figure 4).

RESTRAINT SYSTEMS

The Escape hybrid restraint system features include:

- Dual-stage driver and single-stage front passenger airbags.
- Side curtain rollover protection system.
- Thorax-protecting side impact airbags for the front seat occupants.
- Occupant Classification Sensing (OCS) for the front passenger airbag.
- Safety belt pre-tensioners and energy management retractors.

COLLISION ENERGY MANAGEMENT

The Escape hybrid front structure has structural energy management zones for frontal and offset frontal impacts. The front rails have structural composite reinforcements to tailor the rate at which they absorb energy and help prevent deformation of the passenger compartment.



Figure 3—The high voltage battery is located in the rear cargo area.



Figure 4—The optional 110-volt outlet on the center console.

UNIQUE PARTS

The following table provides locations and descriptions of unique hybrid parts.

	Part	Location	Description
1	Rear Inertia Switch	Passenger side, behind right rear trim panel	Disconnects high voltage and fuel in a collision
2	High Voltage Service Disconnect Switch	Located on the top, passenger side, of the high voltage battery. It has a molded plastic handle that is safety orange in color for easy identification.	Provides high voltage battery disconnect for service. It has a molded plastic handle that is safety orange in color for easy identification
3	High Voltage Battery	Rear of vehicle, below carpet	Sealed Nickel-Metal Hydride (300 + volts)
4	High Voltage Wiring	Orange wire, runs along the bottom of the vehicle between the high voltage battery and the ECVT. Also connects ECVT to the DC/DC converter	Connects high voltage battery to ECVT. Connects ECVT to DC/DC converter. All high voltage wires and connectors will be orange.
5	12-Volt Battery	Driver side of vehicle, under hood, front	Provides 12-volt power. Traditional lead / acid battery.
6	ECVT (Electronically Controlled Continuously Variable Transmission)	Same position as a traditional transaxle	Contains the traction motor, generator motor and hybrid electronics.
7	DC/DC Converter	Passenger side, under hood. Located in front of the shock tower	Provides 12-volt power to charge the battery and run 12V electrical accessories
8	Front Inertia Switch	Passenger compartment, passenger side, front seat, lower kick panel	Disconnects the high voltage circuit and the electrical circuit to the gasoline fuel pump in a collision

CONCLUSION

Repair procedures for the Escape hybrid will be similar to those for the traditional gasoline powered model with a few exceptions, one being the high voltage electrical system. Technicians should always use caution and work safely around any high voltage system. Remember to keep aware of the regenerative braking feature when moving these vehicles around. Be safe by always assuming the vehicle is powered up.

Other features, such as the high voltage battery thermal management system, may present unique repair situations, as well.

For more information on gasoline-electric vehicles, watch for the I-CAR training program, Electric and Electric Hybrid Vehicles (ALT01).