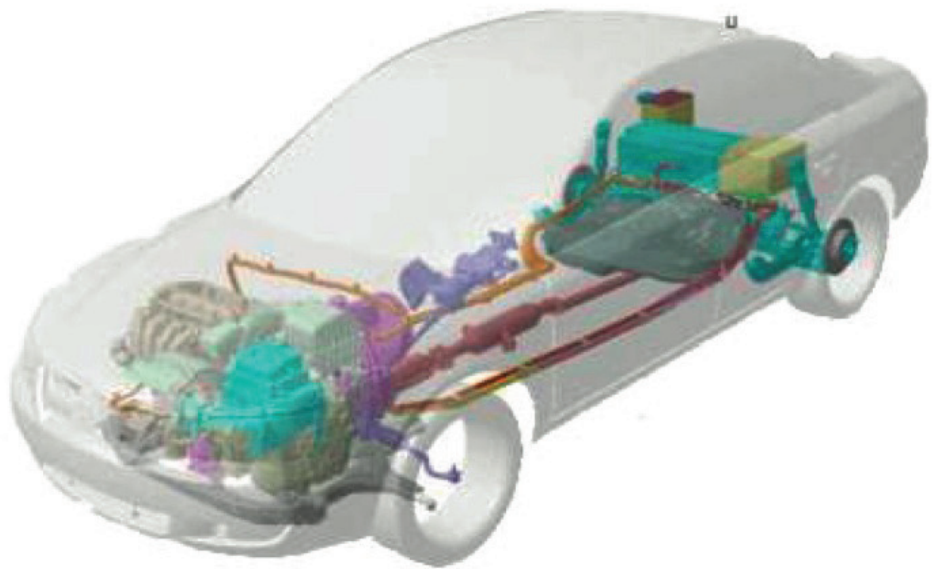


# **KIA EMERGENCY RESPONSE GUIDE**

**OPTIMA HYBRID**



**KIA MOTORS**

## **SAFETY FIRST**

This Emergency Response Guide requires the responder to work closely with a high voltage battery. In order to maximize safety, the emergency response personnel should remove all metallic objects on your person, including but not limited to watches, body piercings, pins, buttons, bracelets, etc., in order to reduce the risk of electrical arcing and potential electrocution. In addition, those emergency response personnel who use metallic medical device, such as pacemakers, insulin pumps, etc., should be aware of the potential risks of working closely with a high voltage battery.

Within this Emergency Response Guide you will find *Notices*, *Cautions*, *Warnings* and *Dangers* which provide critical information and help you do your job safely and efficiently. Below are the definitions of these terms. When you see a *Notice*, *Caution*, *Warning* or *Danger*, be certain you understand the message before you attempt to perform any part of an emergency response procedure.

### **NOTICE**

#### **NOTICE**

*A Notice alerts you to a situation which, if not avoided, could result in vehicle damage.*



#### **CAUTION**

*A Caution alerts you to a hazardous situation which, if not avoided, could result in minor or moderate injury.*



#### **WARNING**

*A Warning alerts you to a hazardous situation which, if not avoided, could result in death or serious injury.*



#### **DANGER**

*A Danger alerts you to a hazardous situation which, if not avoided will result in death or serious injury.*

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## Kia Optima Hybrid Emergency Response Quick Reference

### Step One: Approaching the Vehicle

When approaching the vehicle, **always assume the vehicle is powered up.**

The Kia Optima Hybrid uses a 270V DC voltage system. When the system is powered up, you can be exposed to high voltage currents in excess of **300 Volts!** **Unprotected contact with any electrically charged high-voltage component can cause serious injury or death.**

**ALWAYS follow your existing training and your incident commander's direction.**



#### Electrocution Risk

- Never assume the Kia Optima Hybrid is shut off because it is silent, or engine noise is not present.
- If possible, observe the instrument cluster for the READY indicator status to verify whether the vehicle is on or shut off.
- Failure to shut off and disable the vehicle before emergency response procedures are performed may result in serious injury or death from severe burns and electric shock from the high voltage electrical system, or from accidental deployment of the airbag system.
- Exposed cables or wires may be visible inside or outside the vehicle. Never touch the wires or cables before disabling the system, to prevent injury or death due to electrical shock.

### Step Two: Identifying a Kia Optima Hybrid (Details on Page 5)

You can identify the Kia Optima Hybrid as a hybrid vehicle through the following methods:

- 1) "HYBRID" badge on trunk of vehicle (details on page 6)
- 2) "HYBRID" badge on engine cover (details on page 7)
- 3) VIN Number (details on page 8)
- 4) High Voltage Components (details on page 9)
- 5) High Voltage Warning Labels (details on page 10)
- 6) High Voltage Orange Cabling (details on page 11)
- 7) Hybrid Cluster Instrument Panel (details on page 13)

### **Step Three: Immobilizing the Vehicle and Disabling the System**

Chock the wheels and set the parking brake to immobilize the vehicle (details on page 15).

In the event of a dead battery, use the Emergency Trunk Release Cable to open the trunk (details on page 16).

Disable the vehicle engine and electrical system to prevent current flow using one of the available methods:

- 1) Disabling using the Smart Key and Engine START/STOP Button (details on page 17)
- 2) Safe disconnect of the 12V battery (details on page 18)
- 3) Disable by removing the PDM2 relay (details on page 19)
- 4) Disable by removing the HEV Battery safety plug (details on page 20)

### **Step Four: Safe Extraction of Vehicle Occupants**

Be Aware of Potential Hazards:

- Flammable Fluids (details on page 21)
- Undeployed Airbags and Pretensioners (details on page 22)
- Electric Shock Potential (details on page 24)
- High Voltage Battery Electrolyte (details on page 24)
- 12V Auxiliary Battery Electrolyte (details on page 24)

Take the necessary steps to prevent accidental deployment of undeployed airbags (details page 22).

- 1) Make sure the vehicle ignition switch is turned off.
- 2) Disconnect the negative cable from the 12V auxiliary battery.
- 3) Wait a recommended minimum of 3 minutes for the airbag system to deactivate.

Be aware of front and side driver, passenger, and curtain airbags to avoid cutting into airbag storage locations.

### **Submerged or Partially Submerged Vehicles**

In the event the vehicle is submerged or partially submerged, remove the vehicle from the water before attempting to disable the vehicle.

Use one of the methods described in Step Three to disable the vehicle once it has been removed from the water.



**Electrocution Risk**

Do not touch the safety plug if the vehicle is submerged.

## **Vehicle Fire**

In the event of vehicle fire, use proper vehicle fire fighting practices as recommended by NFPA, IFSTA, or the National Fire Academy (USA).

### **WARNING** Unintended Airbag Deployment

Please be aware that extremely high temperatures of 320-360° F (160-180° C) can cause unintended airbag inflation.

The Kia Optima Hybrid has a Hybrid Battery Air Intake vent located behind the passenger seats in the rear package tray. In the event of an internal vehicle fire, such as a rear seat fire, liquid from the extinguishing process may enter the air intake, and increase the risk of electric shock.

### **DANGER** Electrocutation Risk

Use extreme caution if there is a risk that liquid may have entered the hybrid battery air intake (details page 26).

## **Roadside Assistance Procedures**

- General Towing (details on page 28)
- What if the Vehicle Shuts Off (details on page 28)
- To Jump Start the Car (details on page 29)
- Additional 12V Battery Information (details on page 29)
- Towing – In the Event of an Accident (details on page 30)
- Emergency Trunk Lid Release Cable (details on page 31)



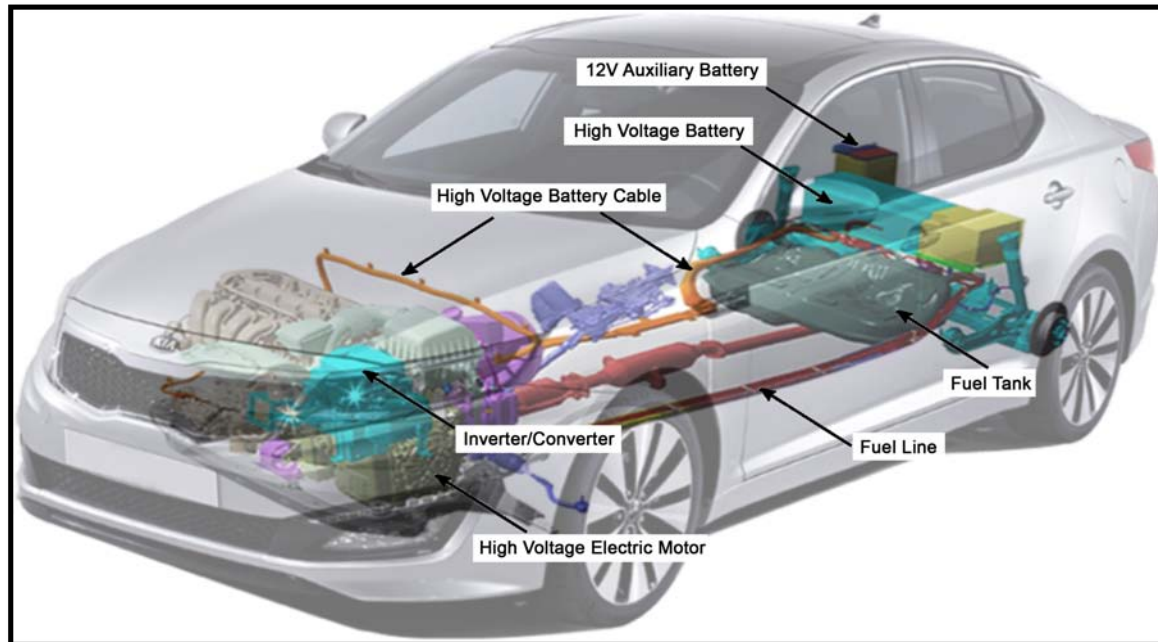
## 1.0 Introduction

### 1.1 Document Purpose

The purpose of this document is to familiarize first responders and the towing/roadside assistance industry with the proper methods to handle the Kia Optima Hybrid in an emergency situation. This guide gives a basic overview of key vehicle systems and instructions for dealing with the different types of emergencies encountered by first responders. The emergency response procedures for this vehicle will be somewhat similar to a conventional Optima, with additional information provided on dealing with the high voltage electrical system.

### 1.2 Vehicle Description

As with other hybrids, the Kia Optima Hybrid uses the combination of a conventional gasoline powered internal combustion engine and a high voltage electric motor to propel the vehicle. This combination provides for improved gas mileage over a conventional Kia as well as an increase in power over the standard 4-cylinder engine. The high voltage electrical system is completely self-contained and does not need to be recharged by an external power source such as a charging station. The high voltage battery is recharged automatically while driving the vehicle. This is accomplished through the use of a generator that produces electricity while driving and braking.





## 2.0 Kia Optima Hybrid Identification

### 2.1 General Vehicle Description

The Kia Optima Hybrid is built on the conventional four-door Optima chassis and therefore the sedan looks very similar to its conventional counterpart with a few notable exceptions. The safest method is to assume that any Optima you respond to is a Hybrid until proven otherwise. Using the information provided in this section, responders will be able to differentiate between the two.

The main high voltage components in the Kia Optima Hybrid are the High Voltage Battery Pack Assembly, the Power Relay Assembly, the Battery Management System ECU, the Hybrid Power Control Unit, the Hybrid Drive Motor, the Hybrid Starter Generator, the Electric A/C Compressor, the Low DC/DC Converter, the Electric Compressor, and Power Cable.

### 2.2 Identifying a Kia Optima Hybrid

There are several ways to identify the Kia Optima Hybrid as a hybrid vehicle.

- 1) “HYBRID” badge on trunk of vehicle
- 2) “HYBRID” badge on engine cover
- 3) VIN Number
- 4) High Voltage Components
- 5) High Voltage Warning Labels
- 6) High Voltage Orange Cabling
- 7) Hybrid Cluster Instrument Panel

## 2.2.1 “HYBRID” Badge on Trunk of Vehicle



The Kia Optima Hybrid can be easily identified by the HYBRID badge located on the trunk lid of the vehicle, below the passenger-side brake light.

### **DANGER** Electrocution Risk

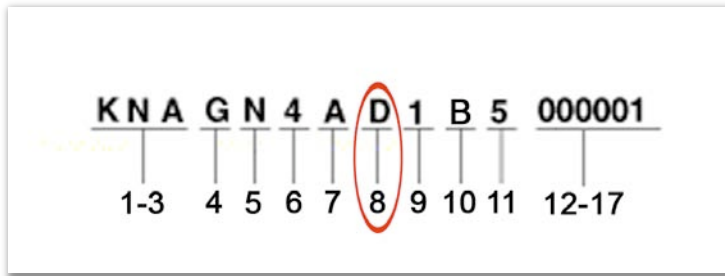
Badging can become hidden after a crash due to damage to the vehicle. Always be sure to utilize additional methods of identification before determining there is no badge present.

### 2.2.2 “HYBRID” Badge On Engine Cover



A “HYBRID” badge is also displayed under the hood on the 2.4L Theta-II engine cover.

## 2.2.3 VIN Number



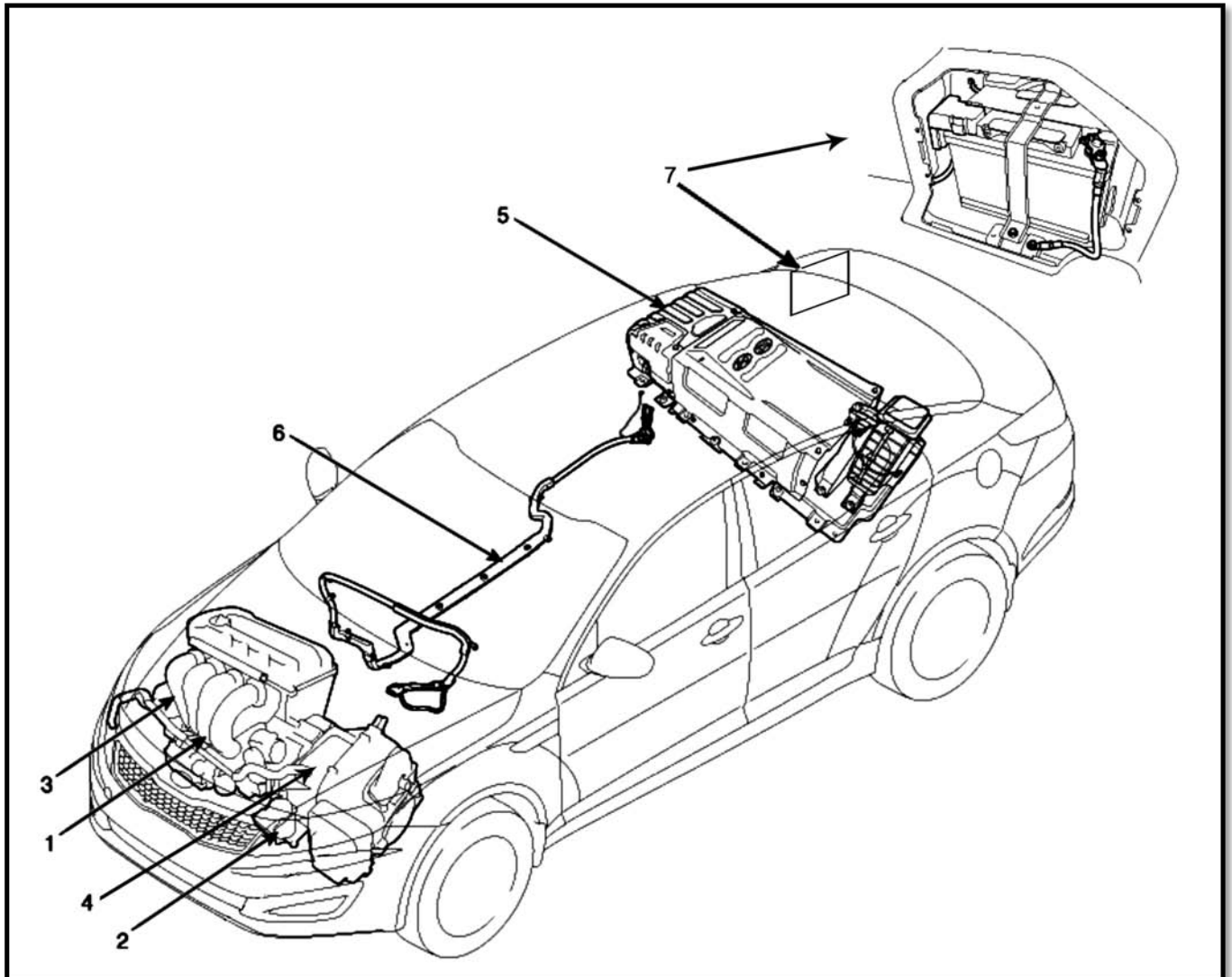
The VIN (Vehicle Identification Number) identifies the engine type as a Hybrid Engine with a “D” displayed in the 8<sup>th</sup> position, as shown in the above drawing. All other engine types for Kia vehicles are numerical.



The VIN can be found:

- 1) Underneath the front passenger seat,
- 2) On a plate attached to the top of the dashboard (easily visible through the windshield from the outside), and
- 3) On the vehicle certification label attached to the driver's side center pillar.

## 2.2.4 High Voltage Components

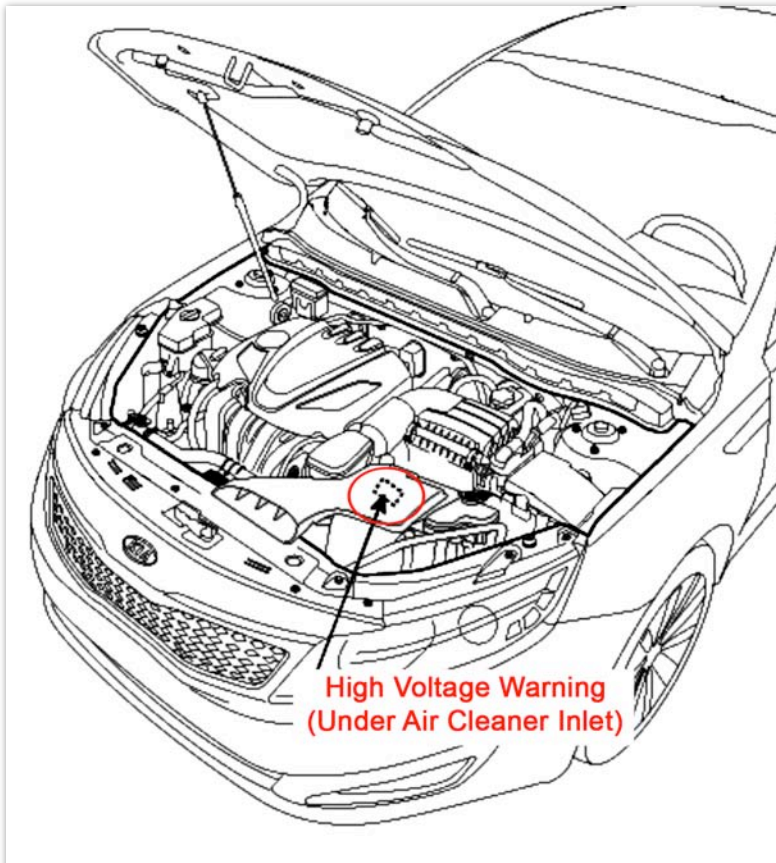


1. A/C Compressor
2. Hybrid Drive Motor
3. Hybrid Starter Generator
4. HPCU
5. High Voltage Battery System
6. Power Cable
7. 12V Auxiliary Battery



## 2.2.5 Warning Labels

**⚠ DANGER** Electrocutation Risk



A High Voltage warning is visible under the hood, on the HPCU cover, located under the Air Cleaner Inlet. The 12V Battery warning is located on the top of the Auxiliary 12V Battery. A High Voltage warning is also visible on the safety plug, located in the trunk of the vehicle.



Examples of High Voltage Warning Labels found under the hood.

## 2.2.6 High Voltage Orange Cabling



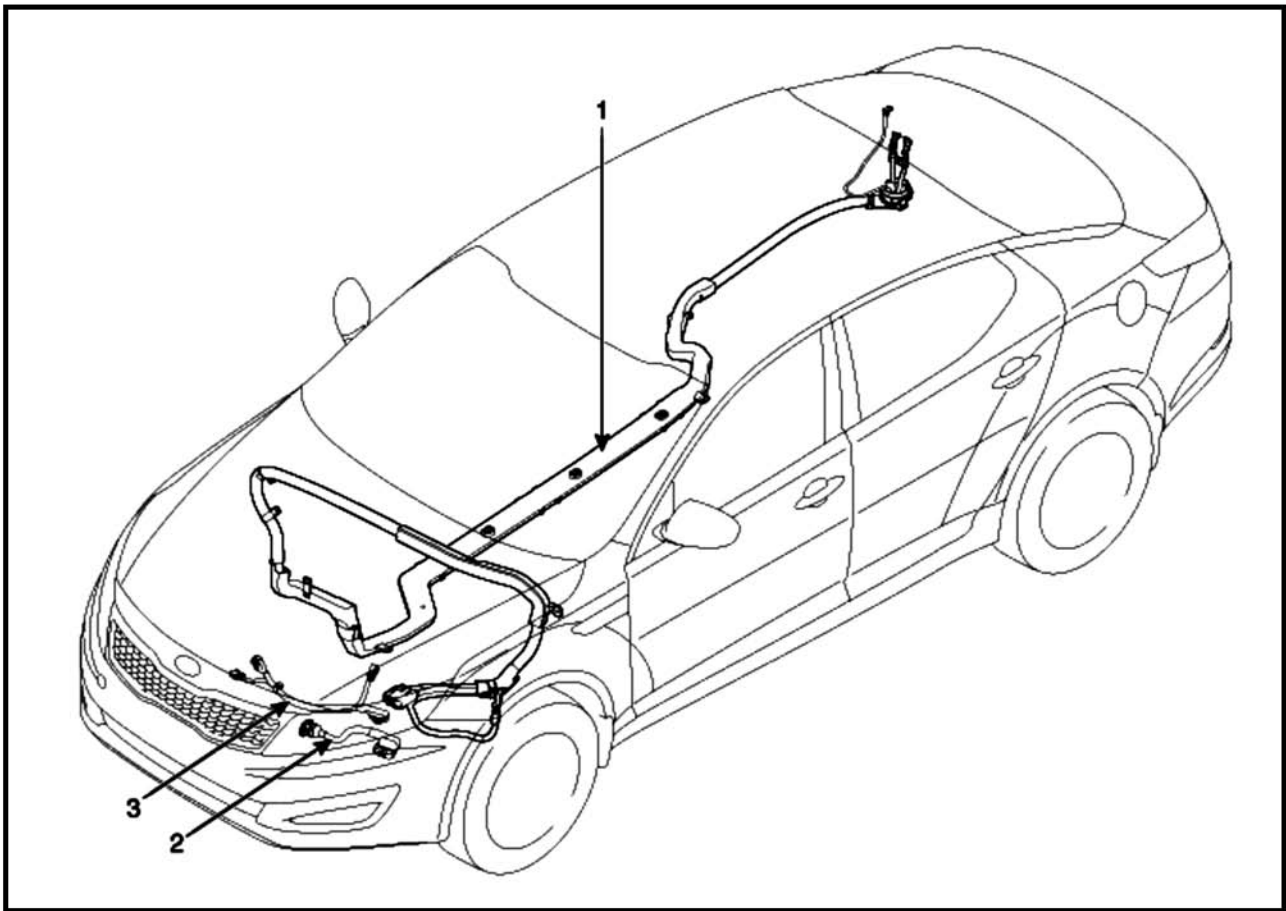
The High Voltage cabling is orange per SAE standard. Cables run from the rear of the vehicle where they connect the High Voltage Battery to the Hybrid Controller, Motor, A/C Compressor, and other High Voltage components at the front of the vehicle.

The presence of orange cables under the hood, in the trunk battery compartment, or orange shielding under the car, identifies the vehicle as a hybrid.

 **DANGER** Electrocuting Risk

Do not cut orange cabling until safety plug is removed. (Refer to page 20.)





The main power cables of the hybrid control system are shown in the above diagram, and are:

- 1) The Main Power Cable,
- 2) The Inverter/Motor Power Cable, and
- 3) The Inverter/HGS and A/C Electric Compressor Power Cable.

## 2.2.7 Hybrid Cluster Instrument Panel



1. State of Charge(SOC) Gauge. 2. ECO Guide Gauge.3. EV Mode Indicator.
4. Ready Light.

The Hybrid Cluster Instrument Panel displays hybrid-specific features that identify the Kia Optima Hybrid as a hybrid vehicle.

- 1) The State of Charge (SOC) gauge is to the left of the cluster, and displays the amount of charge available on the High Voltage Battery.
- 2) The Eco Guide gauge is to the left of the State of Charge gauge, and displays the “ECO GUIDE” label at the top of the gauge.
- 3) The EV Mode Indicator indicates the vehicle is in electric mode.
- 4) The Ready Light indicates the following systems are ready for driving:
  - Starting Signal
  - Park Signal
  - Brake Signal “ON”
  - Immobilizer Ready
  - Related Controllers

The information screens in the center of the instrument cluster display hybrid-specific information about the vehicle, and may also be used to identify the Kia Optima Hybrid as a hybrid vehicle.

## 3.0 Emergency Procedures

### **DANGER** Electrocuting Risk

- Never assume the Kia Optima Hybrid is shut off because it is silent, or engine noise is not present.
- Always observe the instrument cluster for the READY indicator status to verify whether the vehicle is on or shut off.
- Failure to shut off and disable the vehicle before emergency response procedures are performed may result in serious injury or death from severe burns and electric shock from the high voltage electrical system, or from accidental deployment of the airbag system.
- Exposed cables or wires may be visible inside or outside the vehicle. Never touch the wires or cables before disabling the system, to prevent injury or death due to electrical shock.
- Wear Personal Protective Equipment including Safety Glasses and Insulating Gloves rated for 1,000V and above when handling High Voltage components.

### **3.1 Initial Response: Identify, Immobilize and Disable**

The following procedures should be utilized whenever you are dealing with a Kia Optima Hybrid at an emergency scene. All other operations should be consistent with your department's standard operating procedures or guides.

#### **3.1.1 Identify**

When dealing with an Optima at an incident scene, emergency responders should always assume that it is a hybrid model until it can be proven otherwise, using the identification clues outlined in this ERG. External badging will usually be the first clue but it can often be hidden by damage caused in a crash. Always be sure to visualize multiple sides of the vehicles as well as using clues found under the hood and in the interior of the vehicle.

## 3.1.2 Immobilize

The next step is to immobilize the vehicle to prevent any accidental movement that can endanger response personnel and civilians alike. Since the Optima Hybrid has the ability to shut down the gasoline engine when it is not needed, there will be instances where the vehicle appears to be off due to the lack of an engine noise. When it is in “READY” mode, the vehicle can move almost silently on the electric motor alone. Responders should approach the vehicle from the sides and stay away from the front or rear as they are potential paths of travel.



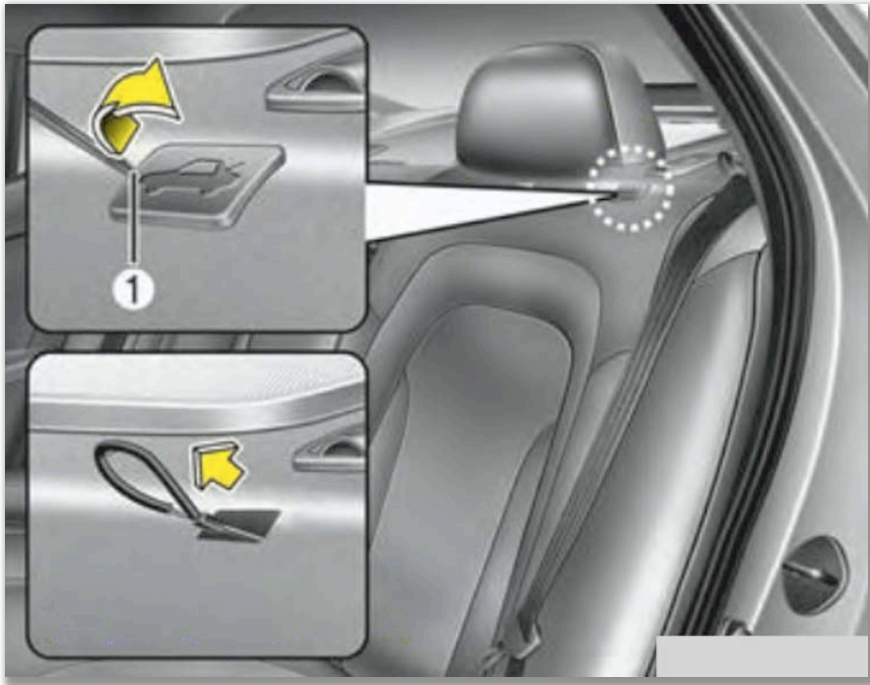
Immobilize the vehicle by first chocking the wheels and setting the parking brake. To engage the parking brake, first apply the foot brake and then depress the parking brake pedal down as far as possible.

## 3.1.3 Disable

The final step in the initial response process, conducted after the vehicle is secured to prevent movement, is to disable the vehicle, its SRS components and the high voltage electrical system.

To prevent current flow through the system, use one of the following procedures to disable the vehicle.

In the event of a dead battery, use the Emergency Trunk Lid Release Cable, located behind the rear passenger headrest, to open the trunk.



To access the Emergency Trunk Lid Release Cable:

1. Remove the cover by using a key (or other tool) to pry it open on the left side.
2. Pull the cable to release the trunk.



## 3.2 Disabling the System – Smart Key System and Engine START/STOP Button

### **DANGER** Electrocutation Risk

This method does not prevent high voltage current flow if Power Relay is damaged.

The Kia Optima Hybrid ignition uses a proximity Smart Key System and Engine START/STOP Button to power up the vehicle. The Smart Key must be located inside the vehicle for the power up procedure to function.

Confirm the status of the READY light on the instrument panel. If the READY light is illuminated, the vehicle is on.

If the READY light is **NOT** illuminated, the vehicle is off. Do not push the Engine START/STOP button because the vehicle may start.

To turn off the system, put the shift lever in the P (Park) position and press the Engine START/STOP button.

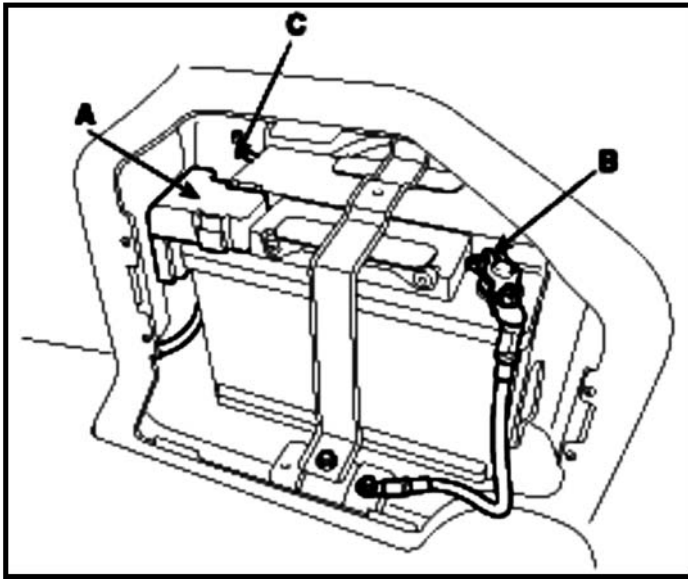
Remove the Smart Key from the vehicle to prevent accidental restart.



Disconnect the negative (-) 12V battery cable, located in the trunk of the vehicle, to further prevent the risk of accidental restart.

## 3.2.1 Safe Disconnect of the 12 Volt Battery

The 12V auxiliary battery is located in the trunk of the vehicle, in the right side of the luggage compartment, and powers all of the vehicle's standard electronics. There is a cover over the 12V DC battery that is simply removed to access the battery.



The battery is maintenance-free, which means it has no removable cell caps. Callout A in the drawing above marks the Positive Battery Terminal, Callout B marks the Negative Battery Terminal, and Callout C marks the Vent Hose, which vents to the outside by the right rear wheel well.

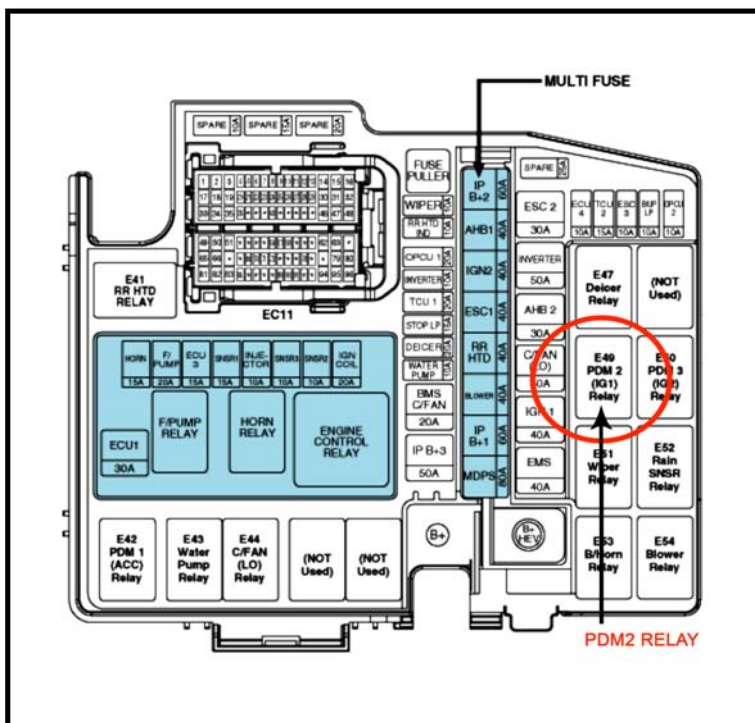
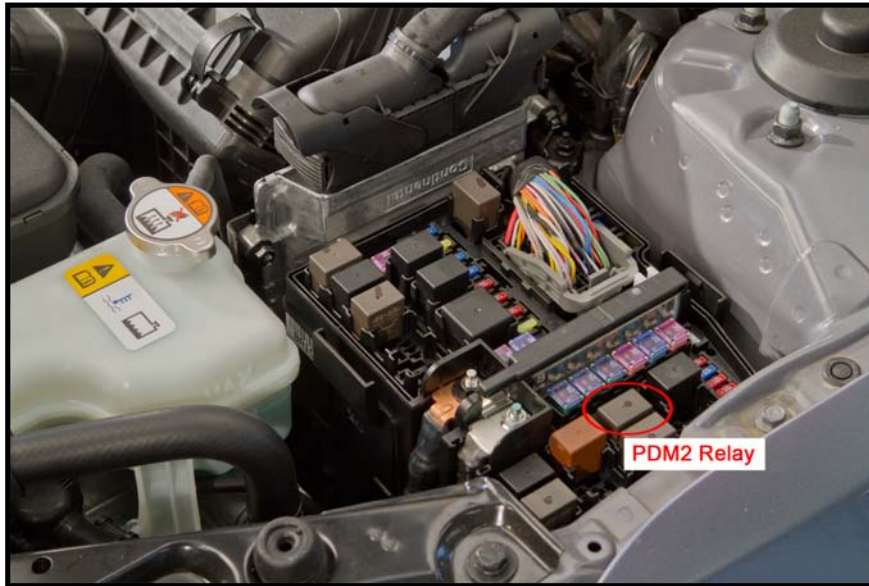
When disconnecting the 12V battery, disconnect the Negative Terminal first.

Before disconnecting the 12V battery (if needed) lower the windows, unlock the doors and open the trunk as required. Once the 12V battery is disconnected, power controls will not operate.



## 3.3 Disabling the System – PDM2 Relay Removal

In the event the vehicle may not be disabled using the START/STOP Button, disconnect the negative (-) 12V battery cable and pull the PDM2 Relay from the under hood engine fuse box.



If the PDM2 Relay cannot be located, pull all the fuses in the Engine Relay Box.

## 3.4 Disabling the System – HEV Safety Plug

The safety plug is located in the rear trunk of the Kia Optima Hybrid and will disable the high voltage battery.



Use the following procedure to remove the plug and disable the high voltage battery:



Wear Personal Protective Equipment including Safety Glasses and Insulating Gloves rated for 1,000V and above when handling High Voltage components.

1. Turn the ignition switch OFF and disconnect the auxiliary 12V battery negative (-) cable.
2. Remove the safety plug access cover.
3. Lift the locking hook up and pull down on the lever.
4. Remove the safety plug.
5. Wait **for more than 5 minutes** to allow the capacitor in the high voltage system to discharge.

## **3.5 Extraction Operations**

When performing an extraction of vehicle occupants, be aware of airbag and restraint locations. Avoid cutting near undeployed airbags, airbag sensors and safety belt sensor equipment.

In the event of a vehicle collision, the sensing system may shut down the high voltage system. When this occurs, the high voltage battery is disconnected.

In the event of a shutdown, the “Check Charging System” message will illuminate on the instrument cluster, and a chime will sound.



### **Electrocution Risk**

Always assume there is power to the system, even if you suspect the sensing system has disabled the high voltage battery.

Ensure the vehicle is disabled before performing extraction (see above).

## **3.6. Potential Hazards**

Please be aware of the following potential hazards, and always take the appropriate safety measures as outlined in your training and specified by your incident commander's direction.

### **3.6.1 Personal Protection Equipment (PPE)**

To ensure safety, wear Personal Protection Equipment (Insulation Gloves and Safety Glasses), and use HV insulated tools when working with the Kia Optima Hybrid.



### **Electrocution Risk**

Do not carry any metallic objects such as a watch or jewelry, as these can cause short circuits to occur. Always make sure that protective gear is not damaged and is free from any tears or moisture.

### **3.6.2 Flammable Fluids**

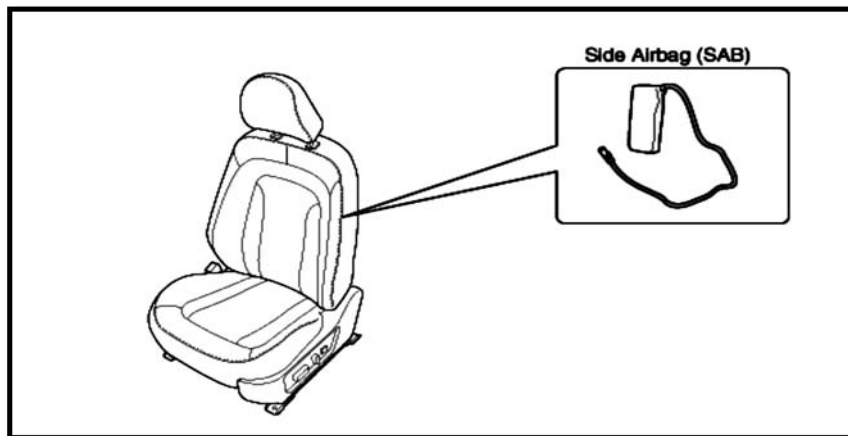
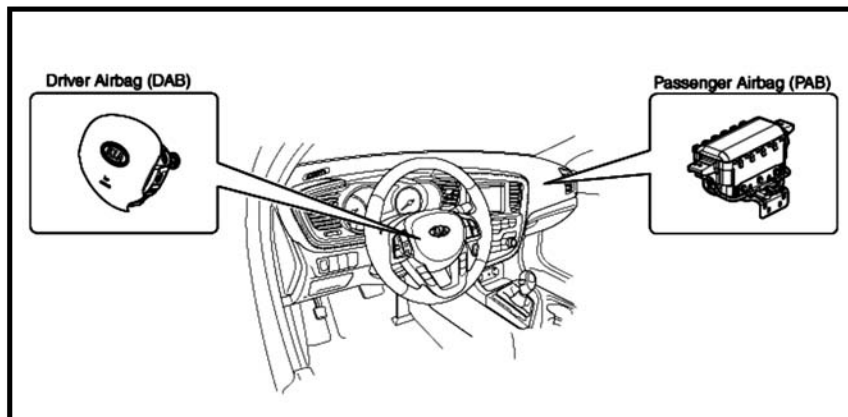
Gasoline: 17.2 Gallons (65 liters)

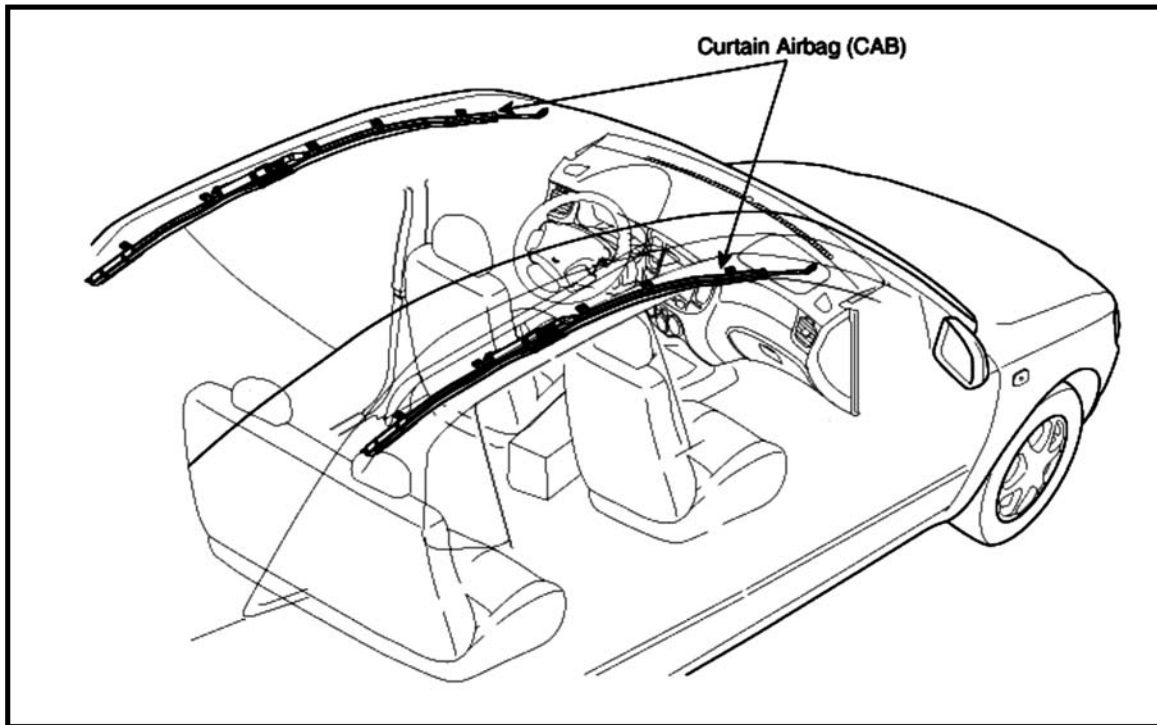
Engine Oil: 4.76 Quarts (4.5 liters)

Automatic Transaxle Fluid: 6.87 Quarts (6.5 liters)

## 3.6.3 Undeployed Airbags and Pretensioners

The Kia Optima Hybrid is equipped with a driver's front and side air bag, passenger's front and side airbag, and curtain air bags.





To prevent accidental deployment of undeployed airbags, make sure the vehicle ignition switch is turned off, disconnect the negative cable from the 12V auxiliary battery, and recommended wait at least 3 minutes to allow the system to deactivate.

## **WARNING** Unintended Airbag Deployment

To reduce the risk of injury during the 3-minute deactivation period, the following safety precautions are recommended:

- Keep out of the path of an undeployed airbag. Refer to the above diagrams for the location of front, side and curtain airbags.
- Do not cut into the center of the steering wheel or the dashboard where front airbags are stored.
- Do not cut into the roof headliner where the curtain airbags are stored.
- Be aware that extreme heat temperatures of 320-360° F (160-180° C) can cause unintended airbag inflation.

The Kia Optima Hybrid is equipped with driver's and front passenger's pretensioner seat belts. When the pretensioner seat belts are activated in a collision, a loud noise may be heard and fine dust, which may appear to be smoke, may be visible in the passenger compartment. These are normal operating conditions and are not hazardous. The pretensioner seat belt assembly mechanisms may become hot during activation, and may need several minutes to cool after they have been activated.



### 3.6.4 Electric Shock Potential

#### **DANGER** Electrocution Risk

The Kia Optima Hybrid uses a 270V DC voltage system. Unprotected contact with any electrically charged high-voltage component can cause serious injury or death.

To avoid electric shock potential, always wear Personal Protective Equipment including Safety Glasses and Insulating Gloves rated for 1,000V and above when handling High Voltage components or when removing the safety plug from the High Voltage Battery.

When the READY light is on and the EV MODE light is on, the electric motor is operational and the high voltage battery is supplying current to the high voltage system.

### 3.6.5 High Voltage Battery Electrolyte

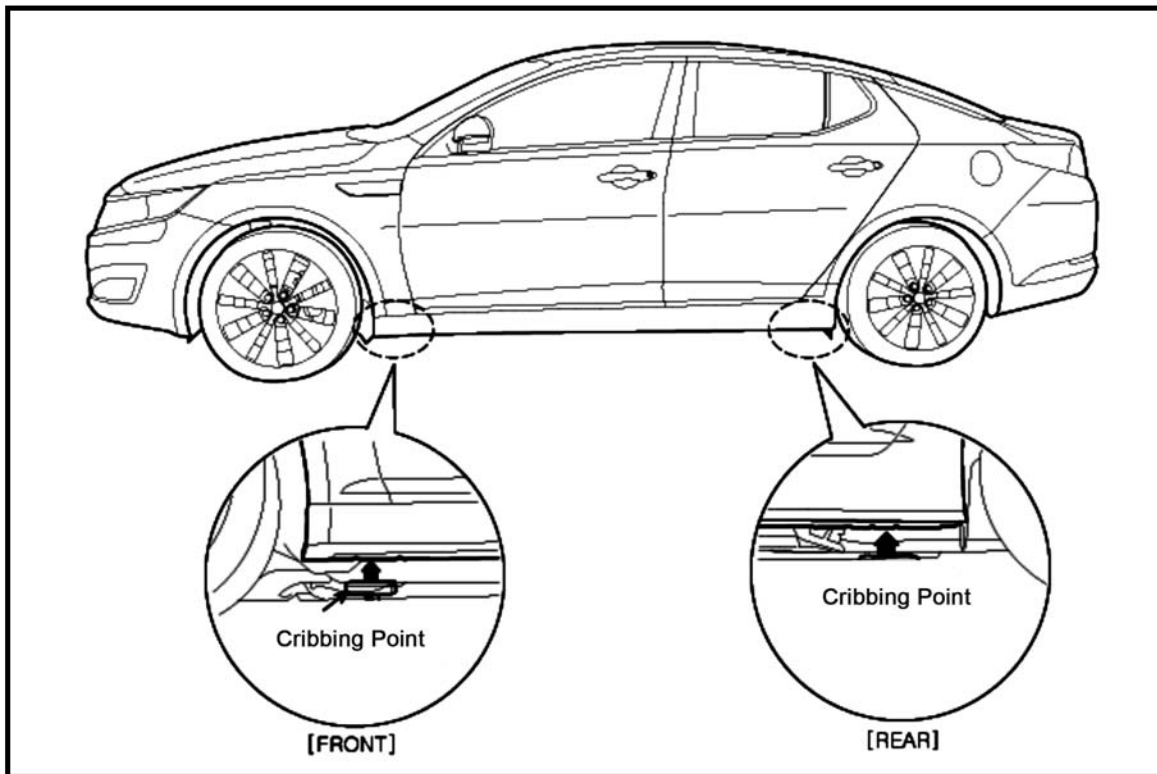
The Kia Optima Hybrid High Voltage Battery Pack Assembly contains a pouch type, 270V lithium-ion polymer battery. In the event of high voltage battery electrolyte leakage, do not touch electrolyte.

### 3.6.6 12V Auxiliary Battery Electrolyte

The 12V auxiliary battery is located in the trunk of the vehicle, in the right side of the luggage compartment.

Electrolyte leakage hazards from the 12V auxiliary battery are the same as those in conventional passenger vehicles.

## **3.7 Vehicle Stabilization**



Utilize standard stabilization (cribbing) points, as shown above. Always be sure to connect to a structural member of the vehicle and avoid placing cribbing under high voltage cables, fuel lines, and other areas not normally considered acceptable

## **3.8 Extrication Equipment and Techniques**

Standard extrication equipment can be utilized on this vehicle and normal techniques and department standard operating procedures and guides should be followed. There are no voltage cables or components in areas that are considered standard cut points. Extrication personnel should always visualize the area being cut to ensure no SRS or High Voltage components are compromised. When utilizing airbags during operations be sure that they are not placed under High Voltage lines or other hazardous areas such as gas lines.



## 3.9 Vehicle Fire

In the event of vehicle fire, use proper vehicle fire fighting practices as recommended by NFPA, IFSTA, or the National Fire Academy (USA).

### **WARNING** Unintended Airbag Deployment

Extremely high temperatures of 320-360° F (160-180° C) can cause unintended airbag inflation.

## 3.10 Hybrid Battery Air Intake

The High Voltage Battery is cooled and heated by an electric fan. Interior air is pulled in from the rear package tray behind the rear passenger seats through the hybrid battery air intake.



### **DANGER** Electrocutation Risk

If the hybrid battery air intake is blocked, the hybrid battery may overheat. If liquids are spilled into the hybrid battery air intake, there is a risk of electric shock.

## **3.11 Submerged or Partially Submerged Vehicles**

In the event the vehicle is submerged or partially submerged, remove the vehicle from the water before attempting to disable the vehicle.

Use one of the methods described in sections 3.2 to 3.4 to disable the vehicle once it has been removed from the water.

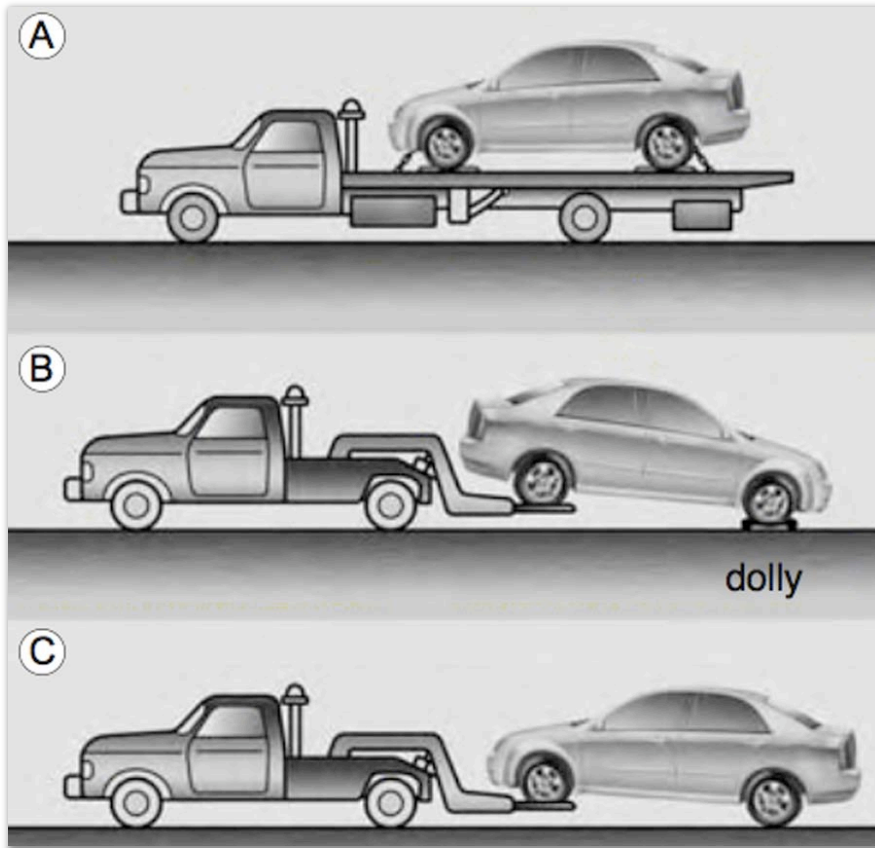
### **DANGER** Electrocution Risk

Do not touch the safety plug if the vehicle is submerged or partially submerged.

## 4.0 Roadside Assistance Procedures

### 4.1 General Towing

Towing a Hybrid can be performed like any other FWD vehicle. Order of preference is A, C & B. Refer to page 6-26 of the Kia Owner's Manual for additional information.



### 4.2 What If the Vehicle Shuts Off

If the high voltage battery or 12V battery become discharged, or the vehicle runs out of gas, the vehicle may not operate.

Before trying to jump-start the vehicle, ensure there is gas in the tank.

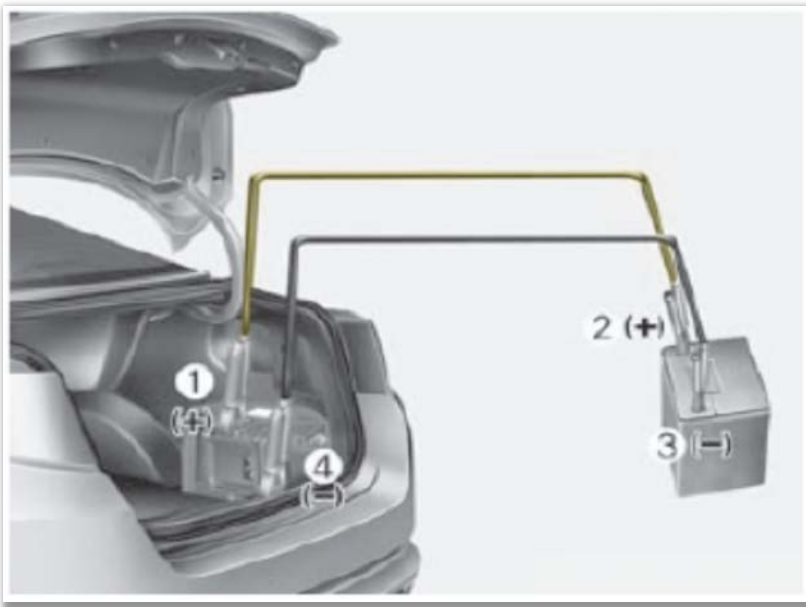
If the vehicle is out of gas, do not drive the vehicle. The high voltage battery could be permanently damaged. Refer to page H13 of the *Kia Owner's Manual* for additional information.

### **4.3 To Jump Start the Car**

#### **DANGER** Electrocutation Risk

Do not attempt to jump start the hybrid 270V high voltage battery.

Attach jumper cables or starting device to the 12V battery in the trunk as you would with any 12V battery (see photo). Refer to page 6-4 of the *Kia Owner's Manual* for additional information.



Connect jumper cables in numerical order and disconnect in reverse order.

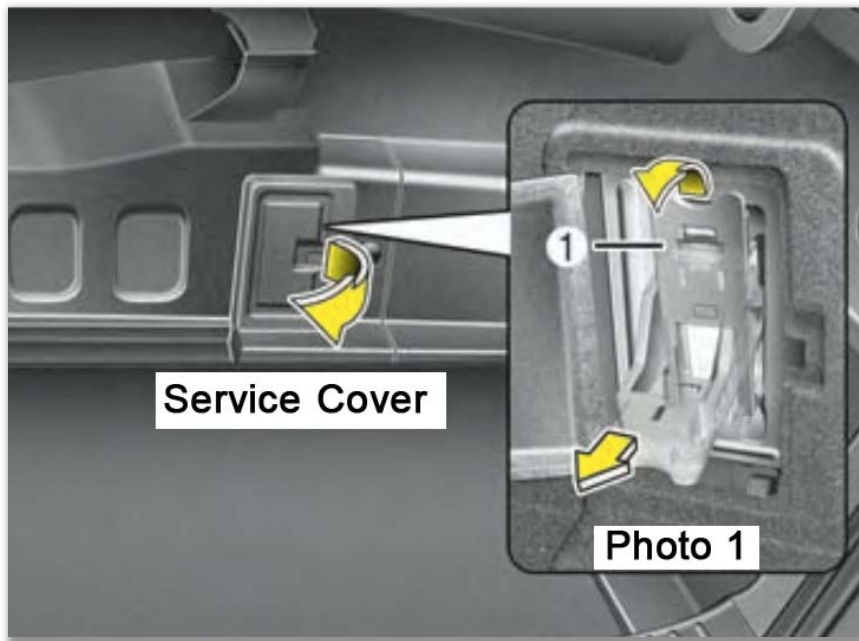
### **4.4 Additional 12V Battery Information**

- The 12V battery is used for the ignition, accessories, and all control modules.
- The 12V battery is not used to crank the engine.
- If the 12V battery is discharged, the control modules will not work.
- Jump-starting the 12V battery should allow the control modules to power up once the Start/Stop Button is pressed.

## 4.5 Towing – In The Event Of An Accident

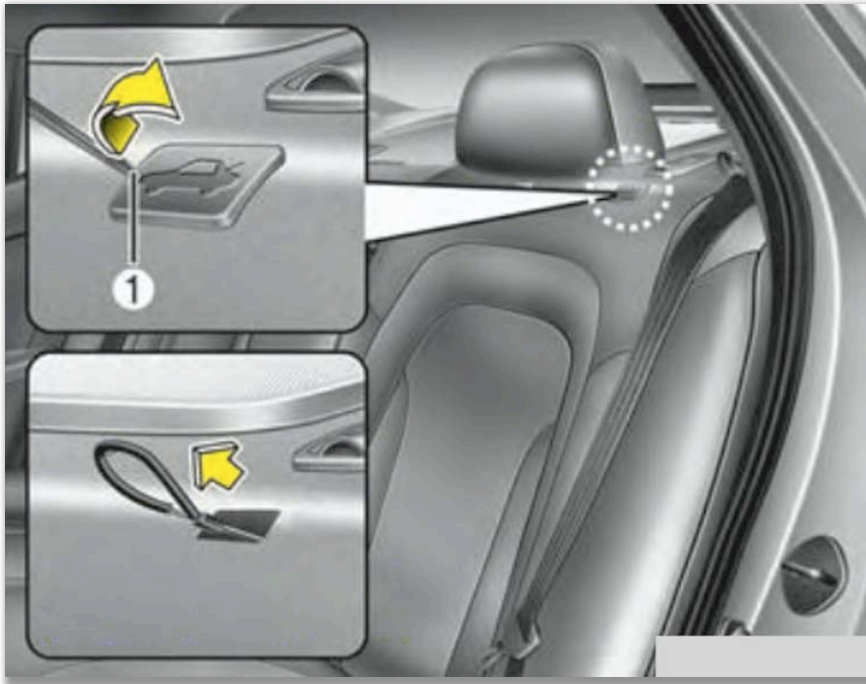
The high voltage system must be disabled. The service plug must be removed from the high voltage battery according to the procedures below.

- Turn ignition switch OFF. While wearing rubber insulating gloves, disconnect the auxiliary 12V battery negative cable. The 12V battery is located in trunk on right side.
- Locate the safety plug in trunk and remove safety plug service cover (photo 1).
- Lift the locking hook (1 & photo 2), rotate the lever down in the direction of arrow (photos 1 & 3), then pull the safety plug out (photos 1 & 4).



**Important:** Wait 5 minutes after removing the plug before working on the vehicle to ensure the remaining voltage in the system has dissipated.

In the event of a dead battery, use the Emergency Trunk Lid Release Cable, located behind the rear passenger headrest, to open the trunk.



To access the Emergency Trunk Lid Release Cable:

1. Remove the cover by using a key (or other tool) to pry it open on the left side.
2. Pull the cable to release the trunk.

## **DANGER** Electrocutation Risk

The hybrid system uses a 270V battery. This battery can be extremely dangerous. High voltage components are color coded orange. Never touch the wires, cables, or connectors if possible. Severe injury, electrocution, or death may occur!

- Do not disassemble any high voltage components
- The hybrid system should only be inspected and or serviced by an authorized Kia dealer
- If battery electrolyte comes in contact with skin or eyes, flush with water and seek medical attention as soon as possible
- If a fire occurs, never use water to extinguish. Use an extinguisher made for electrical fires that has the proper chemicals

Refer to pages H2-H13 of the Kia Owner's Manual for additional HEV information.

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#### Disclaimer

Technical information for this Emergency Response Guide was based on the 2011 Kia Optima Hybrid.  
Information accurate at time of publication.

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