LEXUS

HS 250h

Gasoline-Electric

Hybrid Synergy Drive

HYBRID VEHICLE DISMANTLING MANUAL

ANF10 Series

Foreword

This guide was developed to educate and assist dismantlers in the safe handling of Lexus HS250h gasoline-electric hybrid vehicles. HS250h dismantling procedures are similar to other non-hybrid Lexus vehicles with the exception of the high voltage electrical system. It is important to recognize and understand the high voltage electrical system features and specifications of the Lexus HS250h, as they may not be familiar to dismantlers.

High voltage electricity powers the A/C compressor, electric motors, generator, and inverter/converter. All other conventional automotive electrical devices such as the headlights, radio, and gauges are powered from a separate 12 Volt auxiliary battery. Numerous safeguards have been designed into the HS250h to help ensure the high voltage, approximately 244.8 Volt, Nickel Metal Hydride (NiMH) Hybrid Vehicle (HV) battery pack is kept safe and secure in an accident.

The NiMH HV battery pack contains sealed batteries that are similar to rechargeable batteries used in some battery operated power tools and other consumer products. The electrolyte is absorbed in the cell plates and will not normally leak out even if the battery is cracked. In the unlikely event the electrolyte does leak, it can be easily neutralized with a dilute boric acid solution or vinegar.

High voltage cables, identifiable by orange insulation and connectors, are isolated from the metal chassis of the vehicle.

Additional topics contained in the guide include:

- Lexus HS250h identification.
- Major hybrid component locations and descriptions.

By following the information in this guide, dismantlers will be able to handle HS250h-electric vehicles as safely as the dismantling of a conventional non-hybrid automobile.

Table of Contents

About the HS250h

The HS250h sedan joins the LS 600h L, RX 450h and GS 450h as a hybrid model for Lexus. Lexus Hybrid Drive means that the vehicle contains a gasoline engine and an electric motor for power. The two hybrid power sources are stored on board the vehicle:

1. Gasoline stored in the fuel tank for the gasoline engine.
2. Electricity stored in a high voltage Hybrid Vehicle (HV) battery pack for the electric motor.

The result of combining these two power sources is improved fuel economy and reduced emissions. The gasoline engine also powers an electric generator to recharge the battery pack; unlike a pure all electric vehicle, the HS250h never needs to be recharged from an external electric power source.

Depending on the driving conditions one or both sources are used to power the vehicle. The following illustration demonstrates how the HS250h operates in various driving modes.

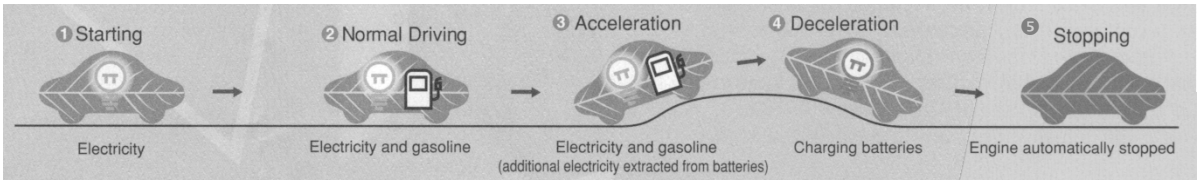
❶ During light acceleration at low speeds, the vehicle is powered by the electric motor. The gasoline engine is shut off.

❷ During normal driving, the vehicle is powered mainly by the gasoline engine. The gasoline engine also powers the generator to recharge the battery pack.

❸ During full acceleration, such as climbing a hill, both the gasoline engine and the electric motor power the vehicle.

❹ During deceleration, such as when braking, the vehicle regenerates the kinetic energy from the wheels to produce electricity that recharges the battery pack.

❺ While the vehicle is stopped, the gasoline engine and electric motor are off, however the vehicle remains on and operational.



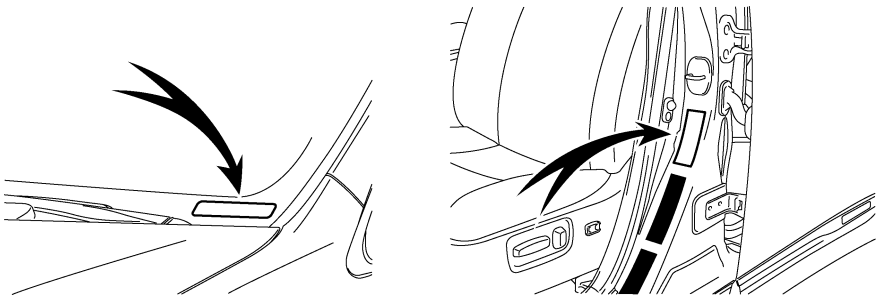
HS250h Identification

In appearance, the 2010 model year HS250h is a 4-door sedan. Exterior, interior, and engine compartment illustrations are provided to assist in identification.

The alphanumeric 17 character Vehicle Identification Number (VIN) is provided in the front windshield cowl, driver door pillar, and engine compartment.

Example VIN: JTHBB1BAA82020211

An HS250h is identified by the first 8 alphanumeric characters **JTHBB1BA**.



Driver Side Windshield cowl and Driver Side B Pillar

HS250h Identification (Continued)

Exterior

❶ HS 250h logo on the back door.

❷ HYBRID logo on the rear door moldings.

Exterior Driver Side View

Exterior Front and Rear View

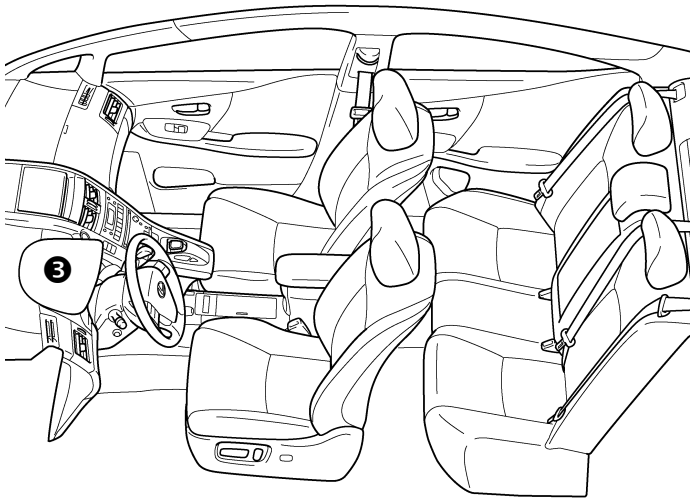
Exterior Rear and Driver Side View

HS250h Identification (Continued)

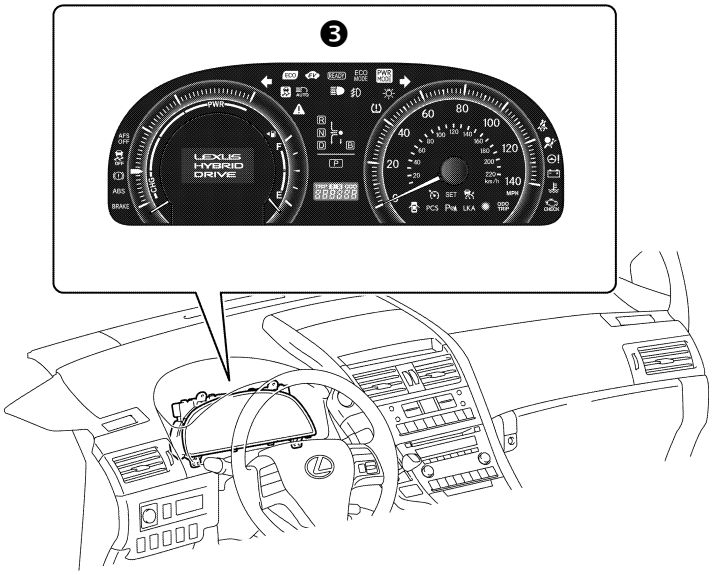
Interior

❸ Instrument cluster (speedometer, power meter, **READY** light, shift position indicators, warning lights) located in the dash behind the steering wheel.

Hint:
If the vehicle is shut off, the instrument cluster gauges will be “blacked out”, not illuminated.



Interior View of Front Door Sill/Scuff Plate

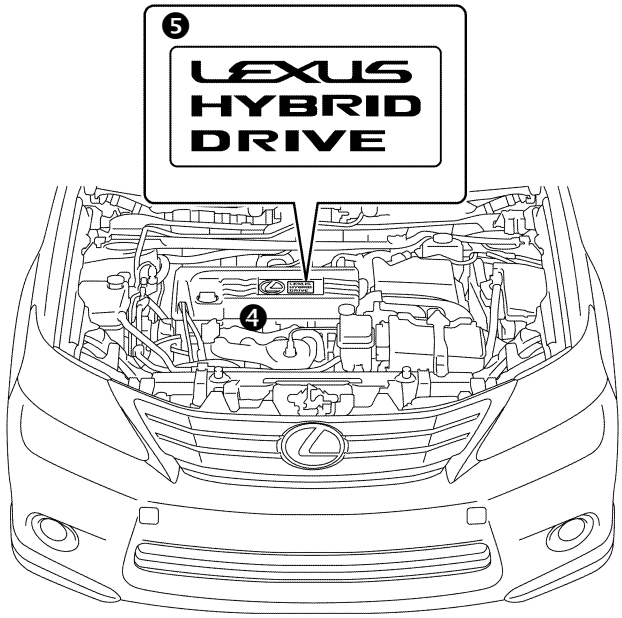


Instrument Cluster View

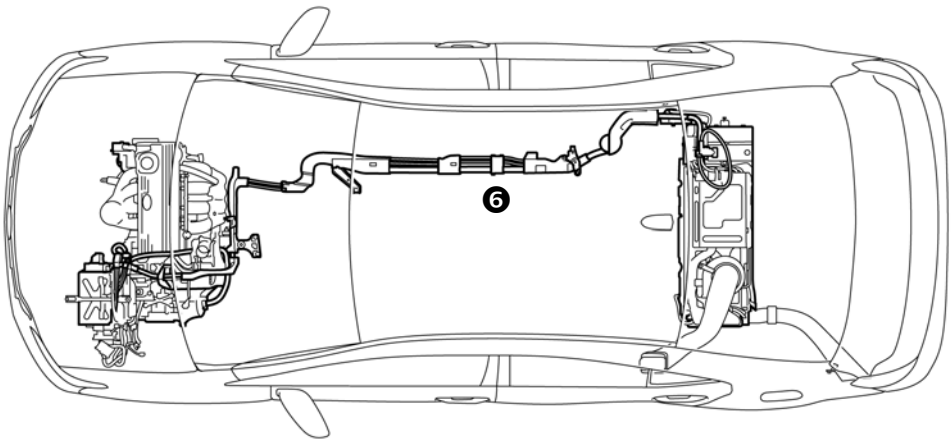
HS250h Identification (Continued)

Engine Compartment

❹ 2.4-liter aluminum alloy gasoline engine.
❺ LEXUS HYBRID DRIVE logo on the plastic engine cover.
❻ Orange colored high voltage power cables.



Engine Compartment View



Power Cables

Hybrid Component Locations & Descriptions

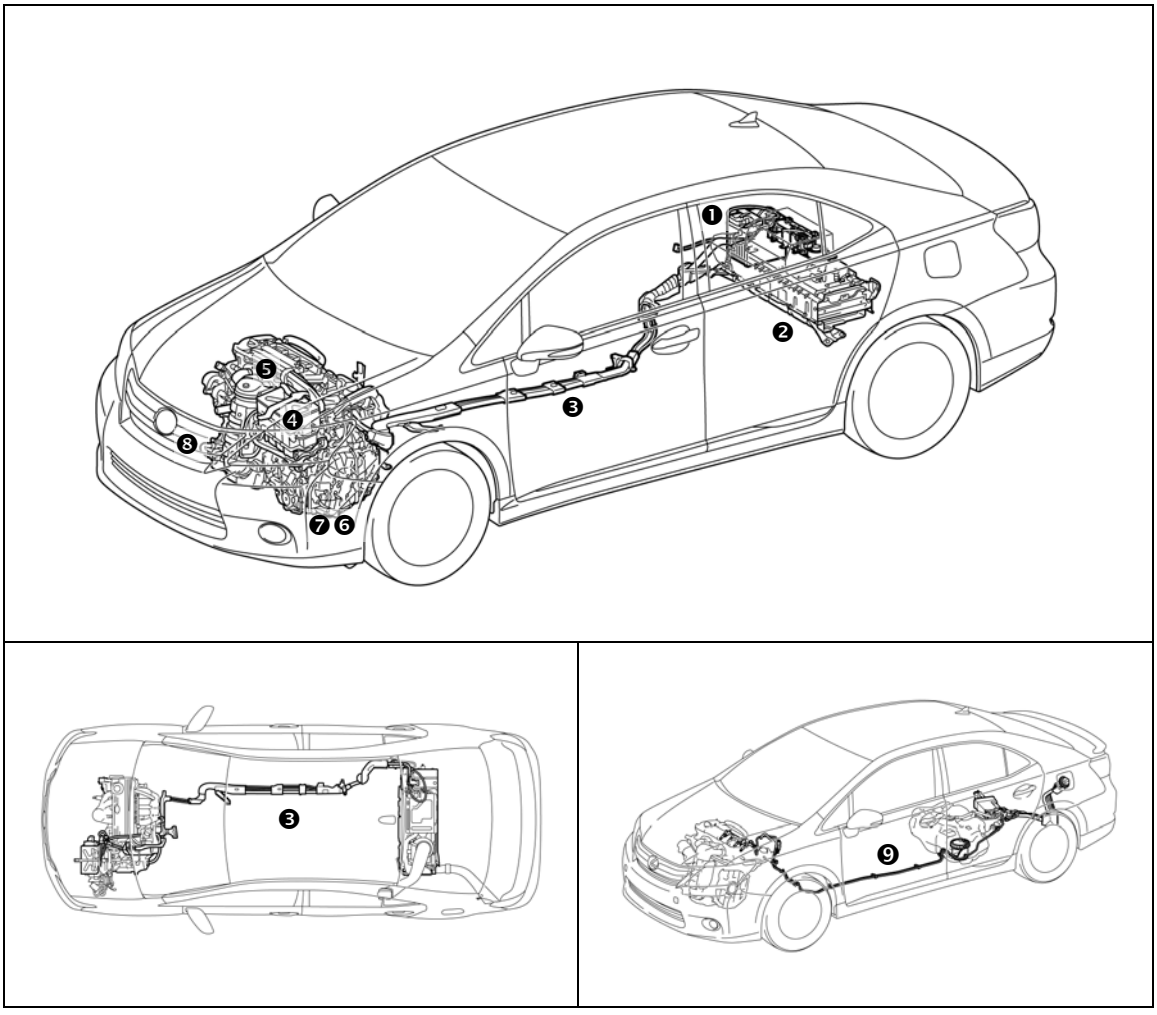
Component	Location	Description
12 Volt ❶ Auxiliary Battery	Trunk Passenger Side	A lead-acid battery that supplies power to the low voltage devices.
Hybrid ❷ Vehicle (HV) Battery Pack	Trunk Area, Mounted to Cross Member and behind Rear Seat	244.8 Volt Nickel Metal Hydride (NiMH) battery pack consisting of 34 low voltage (7.2 Volt) modules connected in series.
Power ❸ Cables	Undercarriage and Engine Compartment	Orange colored power cables carry high voltage Direct Current (DC) between the HV battery pack, inverter/converter, and A/C compressor. These cables also carry 3-phase Alternating Current (AC) between the inverter/converter, electric motors, and generator.
Inverter/ Converter ❹	Engine Compartment	Boosts and inverts the high voltage electricity from the HV battery pack to 3-phase AC electricity that drives the electric motors. The inverter/converter also converts AC electricity from the electric generator and electric motors (regenerative braking) to DC that recharges the HV battery pack.
Gasoline ❺ Engine	Engine Compartment	Provides two functions: 1) Powers vehicle. 2) Powers generator to recharge the HV battery pack. The engine is started and stopped under control of the vehicle computer.
Electric❻ Motor	Engine Compartment	3-phase high voltage AC permanent magnet electric motor contained in the front transaxle. It is used to power the front wheels.
Electric ❼ Generator	Engine Compartment	3-phase high voltage AC generator that is contained in the transaxle and recharges the HV battery pack.
A/C Compressor (with Inverter) ❽	Engine Compartment	3-phase high voltage AC electrically driven motor compressor.
Fuel Tank and Fuel Line ❾	Undercarriage and Center	The fuel tank provides gasoline via a fuel line to the engine. The fuel line is routed under the center of vehicle.

*Numbers in the component column apply to the illustrations on the following page.

Hybrid Component Locations & Descriptions (Continued)

Specifications

Gasoline Engine:	147 hp (110 kW), 2.4-liter Aluminum Alloy Engine
Electric Motors	141 hp (105 kW), Permanent Magnet Motor
Transmission:	Automatic Only (electrically controlled continuously variable transaxle)
HV Battery:	244.8 Volt Sealed NiMH-Battery
Curb Weight:	3,770 lbs/1,710 kg
Fuel Tank:	14.5 Us.gals/55.0 liters
Frame Material:	Steel Unibody
Body Material:	Steel Panels except for Aluminum Hood
Seating Capacity:	5 standard



Lexus Hybrid Drive Operation

Once the **READY** indicator is illuminated in the instrument cluster, the vehicle may be driven. However, the gasoline engine does not idle like a typical automobile and will start and stop automatically. It is important to recognize and understand the **READY** indicator provided in the instrument cluster. When illuminated, it informs the driver that the vehicle is on and operational even though the gasoline engine may be off and the engine compartment is silent.

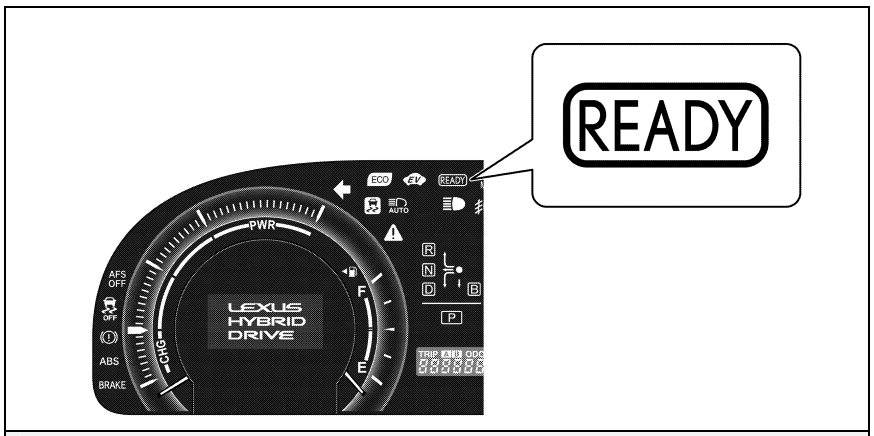
Vehicle Operation

- With the HS250h, the gasoline engine may stop and start at any time while the **READY** indicator is on.

- Never assume that the vehicle is shut off just because the engine is off. Always look for the **READY** indicator status. The vehicle is shut off when the **READY** indicator is off.

The vehicle may be powered by:

1. The electric motor only.
2. The gasoline engine only.
3. A combination of both the electric motor and the gasoline engine.



Instrument Cluster **READY** Indicator

Hybrid Vehicle (HV) Battery Pack and Auxiliary Battery

The HS250h features a high voltage Hybrid Vehicle (HV) battery pack that contains sealed Nickel Metal Hydride (NiMH) battery modules.

HV Battery Pack

- The HV battery pack is enclosed in a metal case and is rigidly mounted to the cabin area floor pan cross member under the second row rear seat. The metal case is isolated from high voltage and concealed by carpet in the cabin area.

- The HV battery pack consists of 34 low voltage (7.2 Volt) NiMH battery modules connected in series to produce approximately 244.8 Volt. Each NiMH battery module is non-spillable and sealed in a metal case.

- The electrolyte used in the NiMH battery module is an alkaline mixture of potassium and sodium hydroxide. The electrolyte is absorbed into the battery cell plates and will not normally leak, even in a collision.

- In the unlikely event that the battery pack is overcharged, the modules vent gases directly outside the vehicle through a vent hose.

HV Battery Pack	
Battery pack voltage	244.8 V
Number of NiMH battery modules in the pack	34
NiMH battery module voltage	7.2 V
NiMH battery module dimensions	5 x 1 x 11 in (118 x 20 x 276 mm)
NiMH module weight	2.3 lbs (1.04 kg)
NiMH battery pack dimensions	19 x 40 x 14 in. (471 x 1010 x 339 mm)
NiMH battery pack weight	121.2 lbs (55 kg)

Components Powered by the HV Battery Pack

- Electric Motor
- Power Cables
- Electric Generator
- Inverter/Converter
- A/C Compressor
- DC-DC Converter

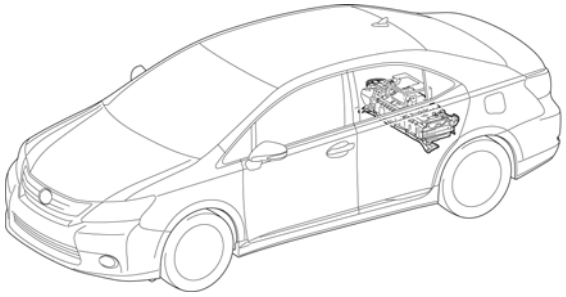
Hybrid Vehicle (HV) Battery Pack and Auxiliary Battery (Continued)

HV Battery Pack Recycling

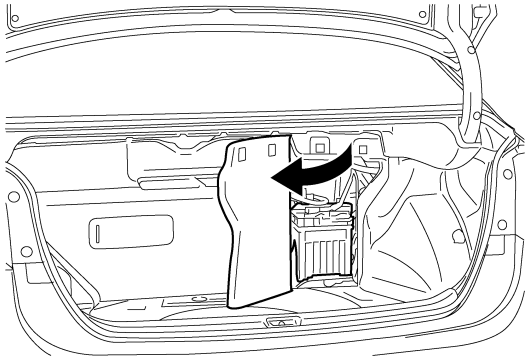
- The HV battery pack is recyclable. Contact either your Lexus Distributor as mentioned on HV battery Caution Label (see page 30) or the nearest Lexus dealer.

Auxiliary Battery

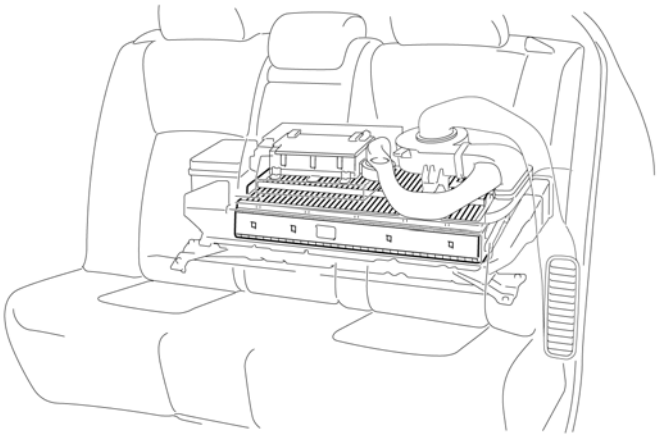
- The HS250h also contains a lead-acid 12 Volt battery. This 12 Volt auxiliary battery powers the vehicle electrical system similar to a conventional vehicle. As with other conventional vehicles, the auxiliary battery is grounded to the metal chassis of the vehicle.
- The auxiliary battery is located in the engine compartment.



244.8 Volt HV Battery Pack



12 Volt Auxiliary Battery in Engine Compartment



HV Battery Pack Mounted in Trunk

High Voltage Safety

The HV battery pack powers the high voltage electrical system with DC electricity. Positive and negative orange colored high voltage power cables are routed from the battery pack, under the vehicle floor pan, to the inverter/converter. The inverter/converter contains a circuit that boosts the HV battery voltage from 244.8 to 650 Volts DC. The inverter/converter creates 3-phase AC to power the motors. Power cables are routed from the inverter/converter to each high voltage motor (front and rear electric motors, electric generator, and A/C compressor). The following systems are intended to help keep occupants in the vehicle and emergency responders safe from high voltage electricity:

High Voltage Safety System

- A high voltage fuse ❶* provides short circuit protection in the HV battery pack.

- Positive and negative high voltage power cables ❷* connected to the HV battery pack are controlled by 12 Volt normally open relays ❸*. When the vehicle is shut off, the relays stop electricity flow from leaving the HV battery pack.

> ***WARNING:***
>
> - ***The high voltage system may remain powered for up to 10 minutes after the vehicle is shut off or disabled. To prevent serious injury or death from severe burns or electric shock, avoid touching, cutting, or opening any orange high voltage power cable or high voltage component.***

- Both positive and negative power cables ❷* are insulated from the metal chassis, so there is no possibility of electric shock when touching the metal chassis.

- A ground-fault monitor continuously monitors for high voltage leakage to the metal chassis while the vehicle is running. If a malfunction is detected, the hybrid vehicle computer ❹* will illuminate the master warning light in the instrument cluster and indicate "CHECK HYBRID SYSTEM" on the multi-information display.

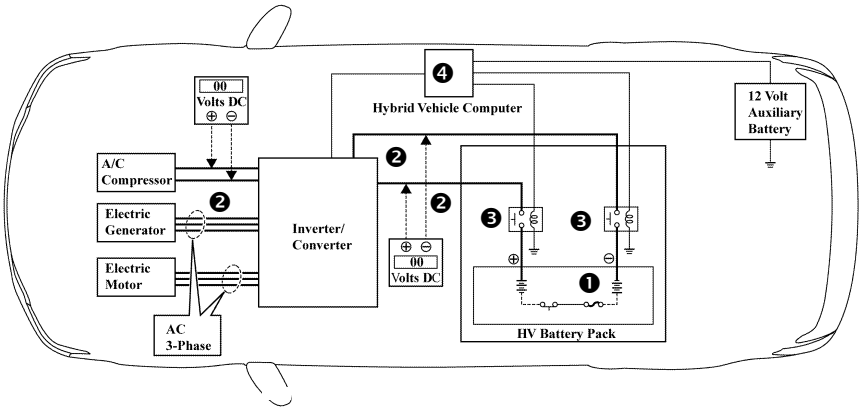
- The HV battery pack relays will automatically open to stop electricity flow in a collision sufficient to activate the SRS.

*Numbers apply to the illustration on the following page.

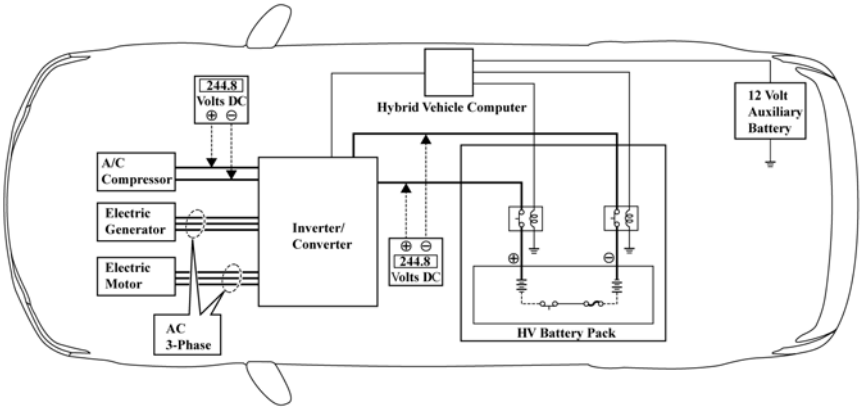
High Voltage Safety (Continued)

Service Plug Grip

- The high-voltage circuit is cut by removing the service plug grip (see page 15).



High Voltage Safety System – Vehicle Shut Off (**READY-OFF**)



High Voltage Safety System – Vehicle On and Operational (**READY-ON**)

Precaution to be observed when dismantling the vehicle

WARNING:

- ***The high voltage system may remain powered for up to 10 minutes after the vehicle is shut off or disabled. To prevent serious injury or death from severe burns or electric shock, avoid touching, cutting, or opening any orange high voltage power cable or high voltage component.***

Necessary Items

- Protective clothing such as insulated gloves (electrically insulated), rubber gloves, safety goggles, and safety shoes.
- Insulating tape such as electrical tape that has a suitable electrical insulation rating.
- Before wearing insulated gloves, make sure that they are not cracked, ruptured, torn, or damaged in any way. Do not wear wet insulated gloves.
- An electrical tester that is capable of measuring DC 750 Volts or more.

Spills

The HS250h contains the same common automotive fluids used in other non-hybrid Lexus vehicles, with the exception of the NiMH electrolyte used in the HV battery pack. The NiMH battery electrolyte is a caustic alkaline (pH 13.5) that is damaging to human tissues. The electrolyte, however, is absorbed in the cell plates and will not normally spill or leak out even if a battery module is cracked. A catastrophic crash that would breach both the metal battery pack case and a metal battery module would be a rare occurrence.

A caustic alkaline is at the opposite end of the pH scale from a strong acid. A safe (neutral) substance is approximately in the middle of this scale. Adding a weak acidic mixture, such as a dilute boric acid solution or vinegar, to the caustic alkaline electrolyte will cause the electrolyte to be neutralized. This is similar but opposite to the use of baking soda to neutralize a lead-acid battery electrolyte spill.

A Lexus Material Safety Data Sheets (MSDS) is attached to this document.

- Handle NiMH electrolyte spills using the following Personal Protective Equipment (PPE):
    - Splash shield or safety goggles. A fold down face shield is not acceptable for acid or electrolyte spills.
    - Rubber, latex or nitrile gloves.
    - Apron suitable for alkaline.
    - Rubber boots.

- Neutralize NiMH electrolyte.
    - Use a boric acid solution or vinegar.
    - Boric acid solution - 800 grams boric acid to 20 liters water or 5.5 ounces boric acid to 1 gallon of water.

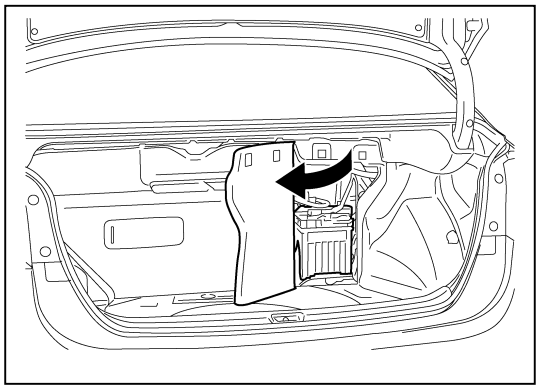
Dismantling the vehicle

The following 2 pages contain general instructions for use when working on an HS250h. Read these instructions before proceeding to the HV battery removal instructions on page 18.

WARNING:

- ***The high voltage system may remain powered for up to 10 minutes after the vehicle is shut off or disabled. To prevent serious injury or death from severe burns or electric shock, avoid touching, cutting, or opening any orange high voltage power cable or any high voltage component.***

1. Shut off the ignition (**READY** indicator is off). Then disconnect the cable from the auxiliary battery negative (-) terminal.

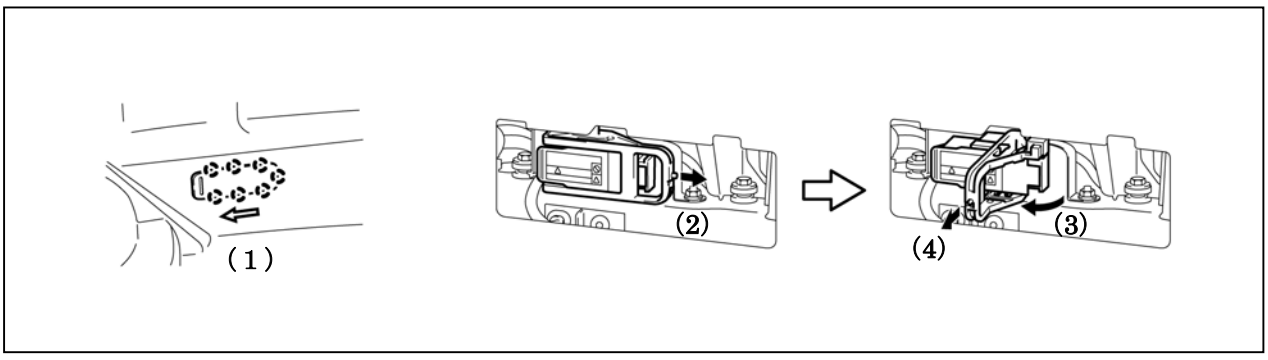


2. Remove the service plug grip.
   (1) Disengage the 2 clips and 2 guides, and remove the battery service hole cover.

   Caution:

   Wear insulated gloves for the following 3 steps.

   (2) Slide the handle of the service plug grip to the left.
   (3) Raise the release handle of the service plug grip.
   (4) Remove the service plug grip.

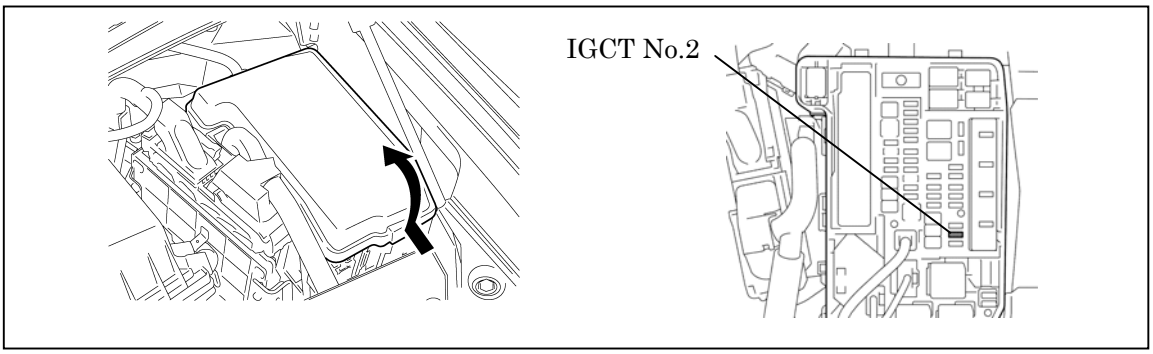


   (5) Apply insulating tape to the socket of the service plug grip to insulate it.

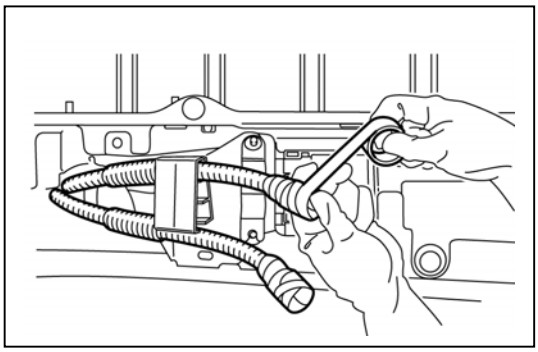
3. Carry the removed service plug grip in your pocket to prevent other staff from accidentally reinstalling it while you are dismantling the vehicle.
4. Make other staff aware that a high-voltage system is being dismantled by using the following sign: CAUTION: HIGH-VOLTAGE. DO NOT TOUCH (see page 17).
5. If the service plug grip cannot be removed due to damage to the vehicle, remove the **IGCT No. 2** fuse (10A).

   Caution:

   This operation shuts off the HV system. Be sure to wear insulated gloves because high voltage is not shut off inside the HV battery. When it is possible to remove the service plug grip, remove it and continue the procedure.



6. After disconnecting or exposing a high-voltage connector or terminal, insulate it immediately using insulating tape. Before disconnecting or touching a bare high-voltage terminal, wear insulated gloves.
7. Check the HV battery and nearby area for leakage. If you find any liquid, it may be strong alkaline electrolyte. Wear rubber gloves and goggles and neutralize the liquid using a saturated boric acid solution or vinegar. Then wipe up the liquid using waste rags etc.



8. If the electrolyte comes into contact with your skin, wash the skin immediately using a saturated boric acid solution or a large amount of water. If the electrolyte adheres to any article of clothing, take the clothing off immediately.
9. If the electrolyte comes into contact with your eye(s), call out loudly for help. Do not rub your eye(s). Instead, wash the eye(s) with a dilute boric acid solution or a large amount of water and seek medical care.
10. With the exception of the HV battery, remove parts by following procedures which are similar to conventional Lexus vehicles. For the removal of the HV battery, refer to the following pages.

Person in charge:

DO NOT TOUCH.

HIGH-VOLTAGE.

CAUTION:

CAUTION:

HIGH-VOLTAGE.

DO NOT TOUCH.

Person in charge:

When performing work on the HV system, fold this sign and put it on the roof of the vehicle.

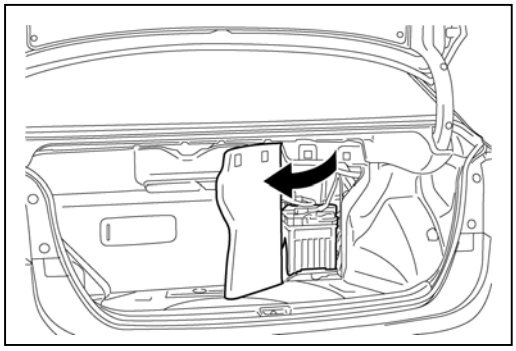
Removal of HV battery

WARNING:

- ***Be sure to wear insulated gloves when handling high-voltage parts.***
- ***Even if the vehicle is shut off and the relays are off, be sure to remove the service plug grip before performing any further work.***
- ***Power remains in the high voltage electrical system for 10 minutes even after the HV battery pack is shut off because the circuit has a condenser that stores power.***
- ***Make sure that the tester reading is 0 V before touching any high-voltage terminals which are not insulated.***
- ***The SRS may remain powered for up to 90 seconds after the vehicle is shut off or disabled. To prevent serious injury or death from unintentional SRS deployment, avoid cutting the SRS components.***

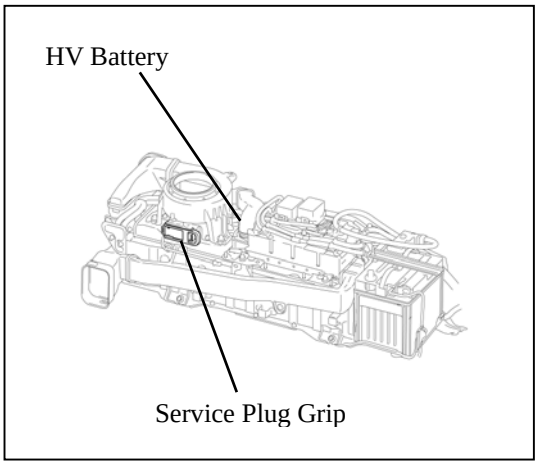
1. Shut off the ignition (**READY** indicator is off).

2. Disconnect the cable from the auxiliary battery negative (-) terminal.
3. Disconnect the cable from the auxiliary battery positive (+) terminal.
4. Remove the 12volt auxiliary battery.



5. Remove the service plug grip.

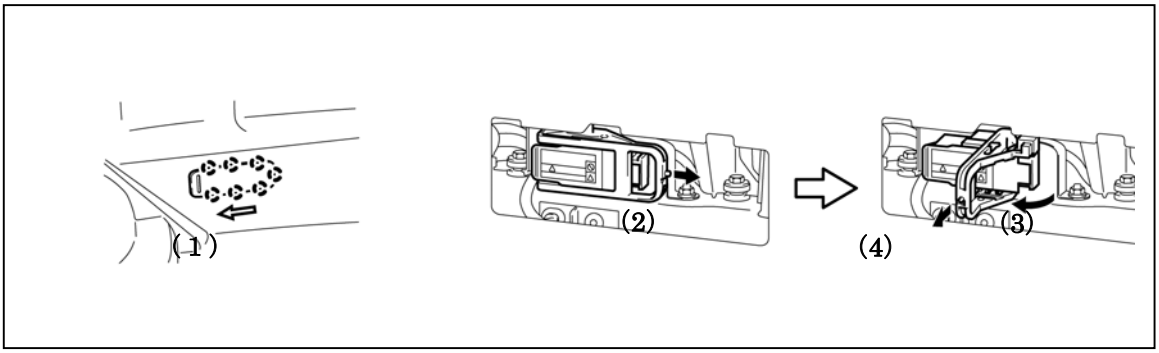
(1) Disengage the 2 clips and 2 guides, and remove the battery service hole cover.
(2) Slide the handle of the service plug grip to the left.



Caution:

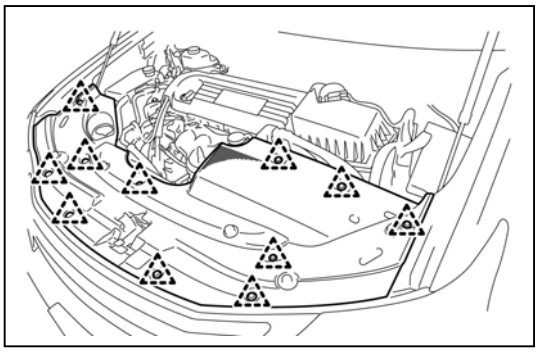
Wear insulated gloves for the following 3 steps.

(3) Raise the release handle of the service plug grip as shown in the illustration below.
(4) Remove the service plug grip.
(5) Apply insulating tape to the socket of the service plug grip to insulate it.

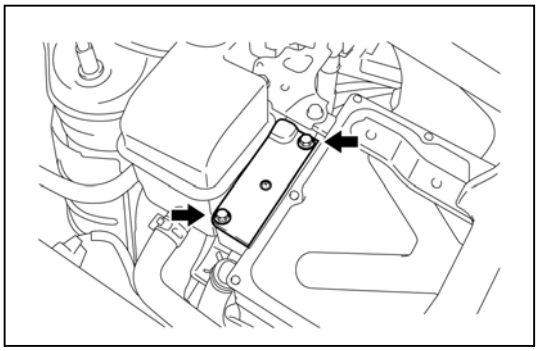


6. Remove the cool air intake duct seal

(1) Remove the 11 clips and cool air intake duct seal.



7. Remove the 2 bolts and connector cover assembly.

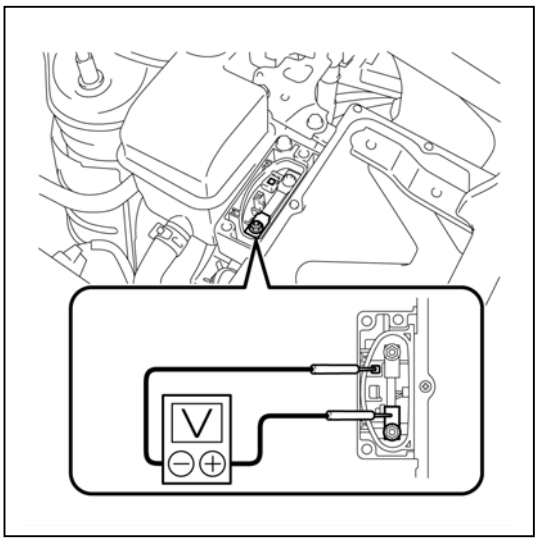


8. Check the voltage at the terminals in the inspection point in the power control unit.

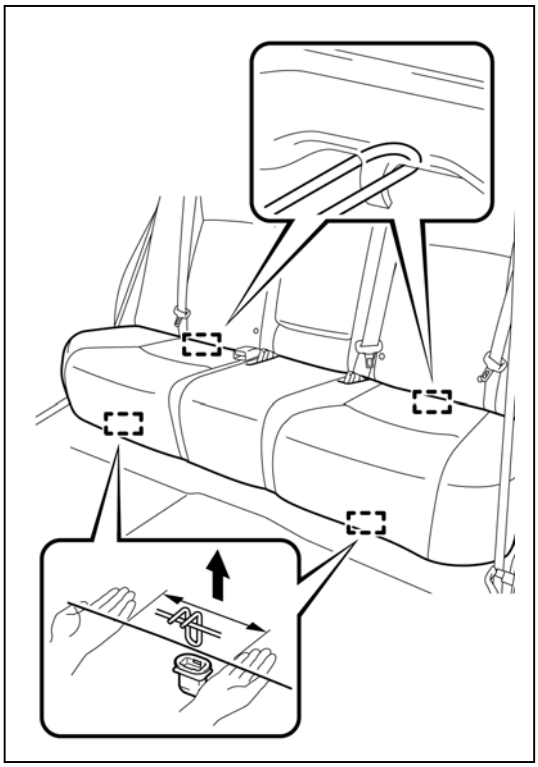
Caution:
Wear insulated gloves.
To prevent serious injury or death, do not proceed with dismantling of the HV system until the voltage at the terminals in the inspection point is 0 V.

Standard voltage: 0 V

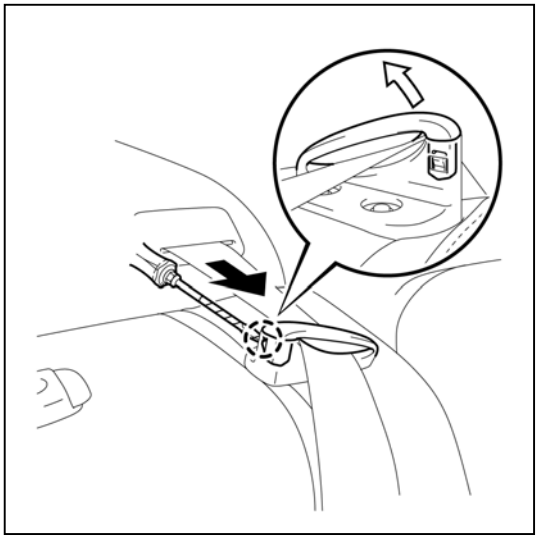
Hint:
Set the tester to DC 750 Volts measure the voltage.
This inspection is performed to verify that it is safe to remove the HV battery.



9. Remove the rear seat cushion assembly.

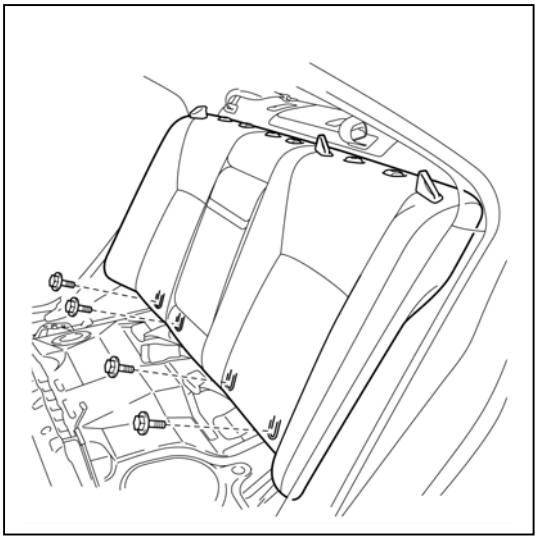


10. Disengage the claw to open the 3 caps of the rear seat shoulder belt guide.



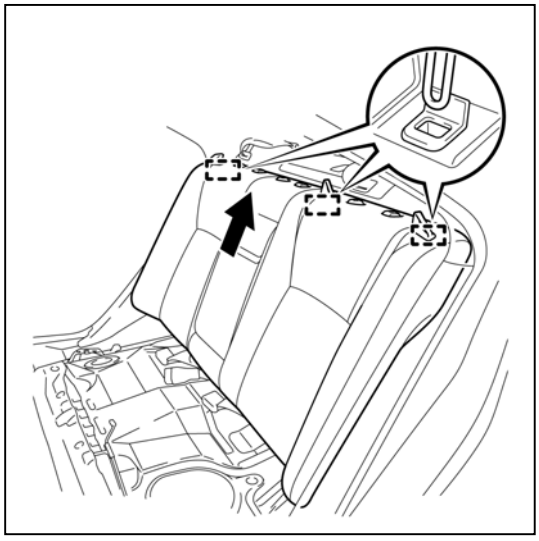
11. Remove the rear seatback assembly.

(1) Remove the 4 bolts.



(2) Disengage the 3 hooks and remove the rear seatback assembly.

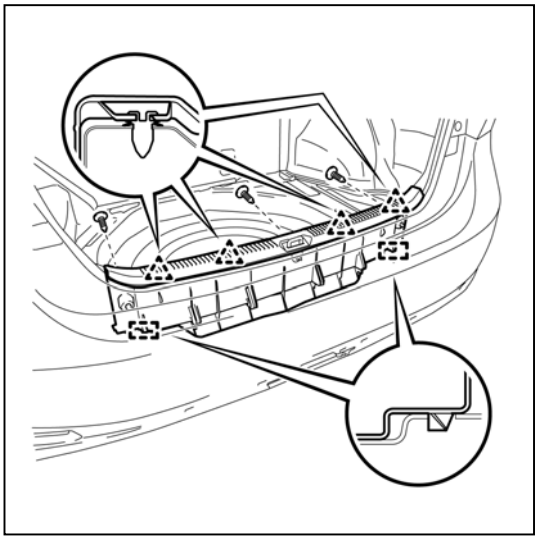
12. Remove the tool with stay box sub-assembly from the trunk.



13. Remove the rear floor finish plate.

(1) Remove the 3 clips.

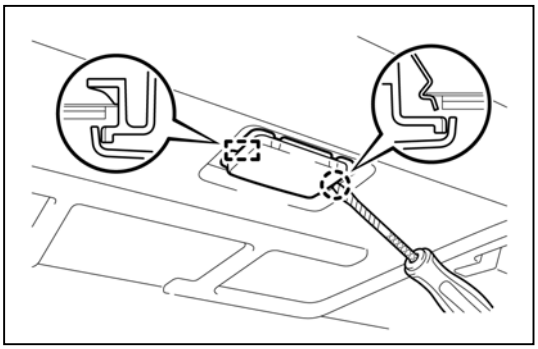
(2) Disengage the 4 clips and 2 guides, and remove the rear floor finish plate.



14. Remove the No. 1 luggage compartment light assembly

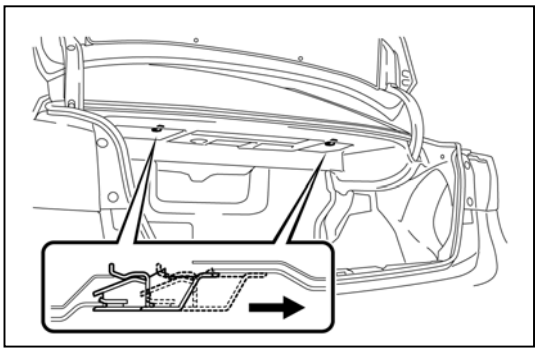
(1) Using a screwdriver, disengage the claw and guide..

(2) Disconnect the connector and remove the No. 1 luggage compartment light assembly



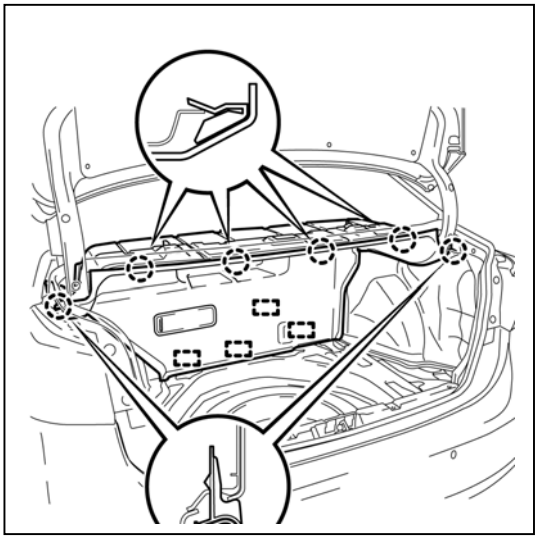
15. Remove the front luggage compartment trim cover.

(1) Remove the 2 No. 2 luggage compartment trim hooks as shown in the illustration.

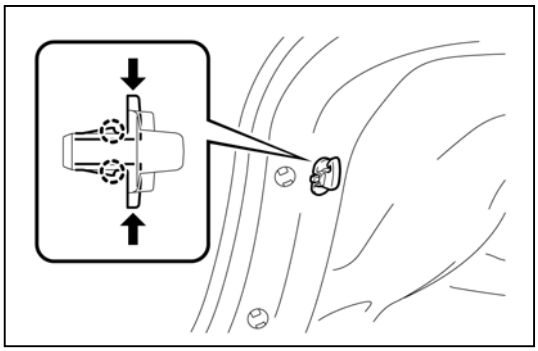


(2) Disengage the 4 claws (A) and (B).

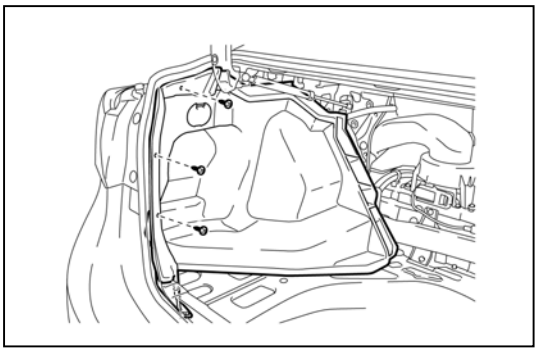
(3) Disengage the 4 fasteners and remove the front luggage compartment trim cover.



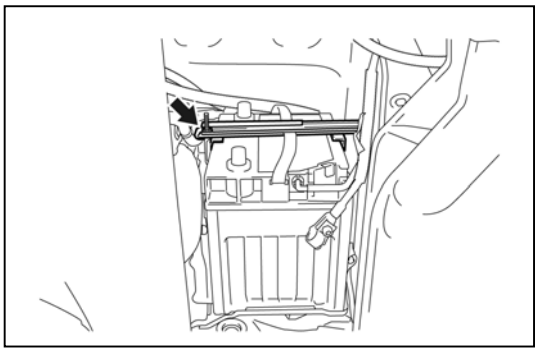
16. Remove the rope hook.



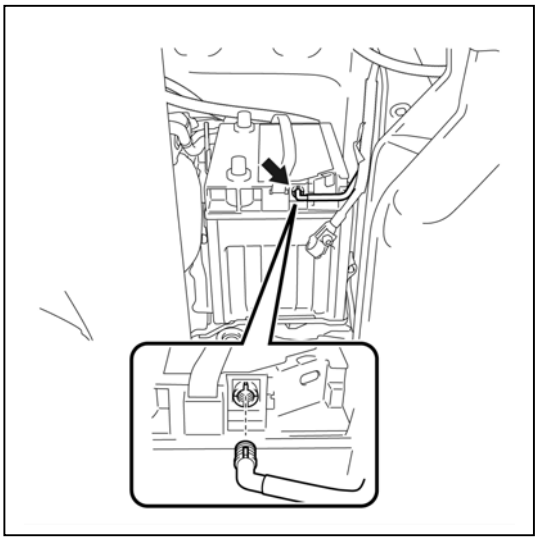
17. Remove the inner luggage compartment trim cover.
    (1) Remove the 3 clips and inner luggage compartment trim cover..



18. Remove the auxiliary battery.
    (1) Loosen the nut and separate the positive (+) battery terminal.
    (2) Remove the nut and battery clamp.

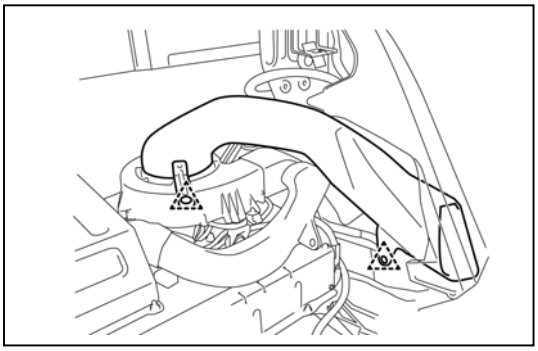


    (3) Disconnect the battery ventilation hose and remove the battery

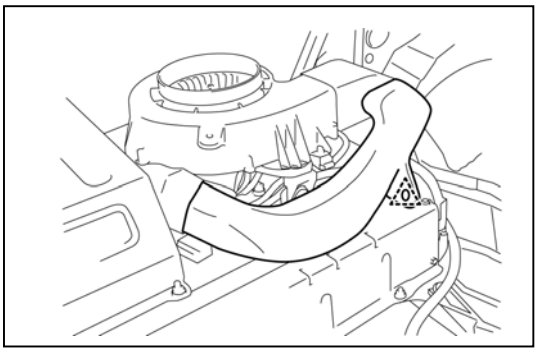


19. Remove the battery cooling blower assembly.

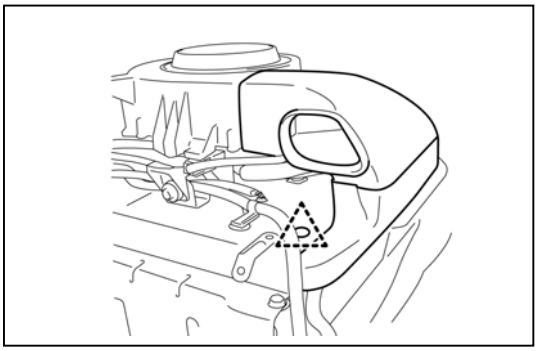
(1) Remove the 2 clips and No. 1 HV battery intake duct.



(2) Remove the clip and No. 4 HV battery intake duct.

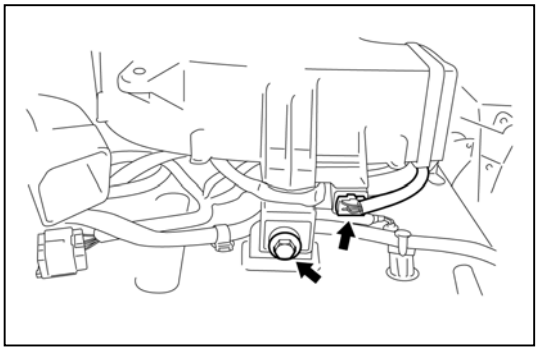


(3) Remove the clip and No. 2 HV battery intake duct with the No. 3 HV battery intake duct.

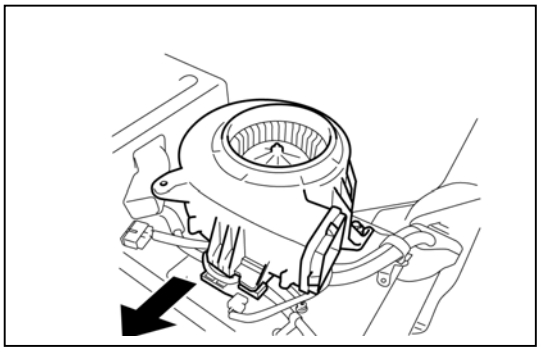


(4) Remove the bolt from the battery cooling blower assembly

(5) Disconnect the connector from the battery cooling blower assembly

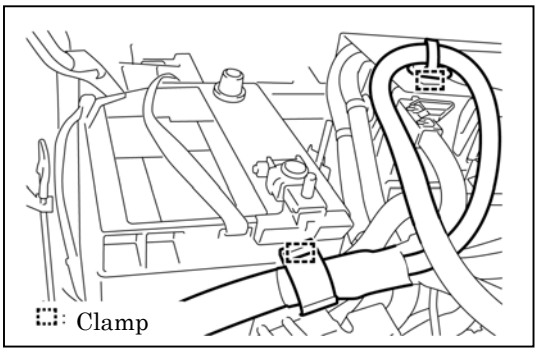


(6) Remove the battery cooling blower assembly as shown in the illustration



20. Disconnect the frame wire.

(1) Disconnect the 2 clamps and frame wire.



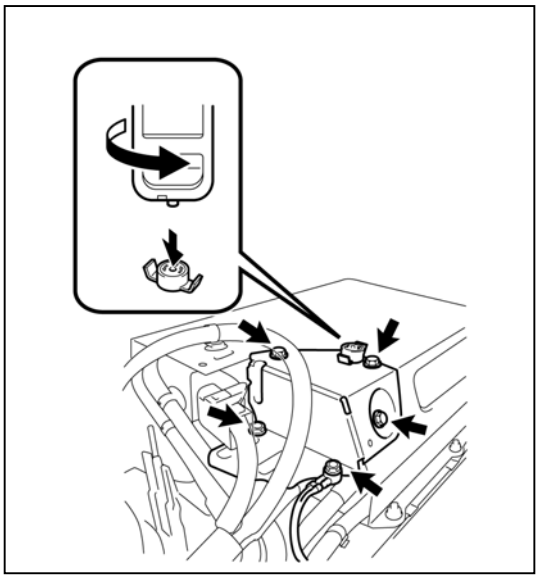
21. Remove the No. 4 hybrid battery shield panel.

Caution:
Wear insulated gloves for the following 2 steps.

(1) Using the service plug grip, remove the battery cover lock striker

Hint:
Insert the projecting part of the service plug grip and turn the button of the battery cover lock striker counterclockwise to release the lock.

(2) Remove the 3 bolts, 2 nuts and No. 4 hybrid battery shield panel

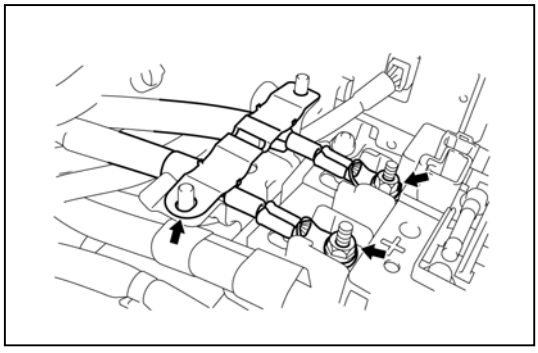


22. Disconnect the frame wire.

Caution:
Wear insulated gloves.

Notice:
Insulate the terminals of the removed frame wire with insulating tape.

(1) Remove the battery shield contact.
(2) Remove the 2 nuts and disconnect the frame wire

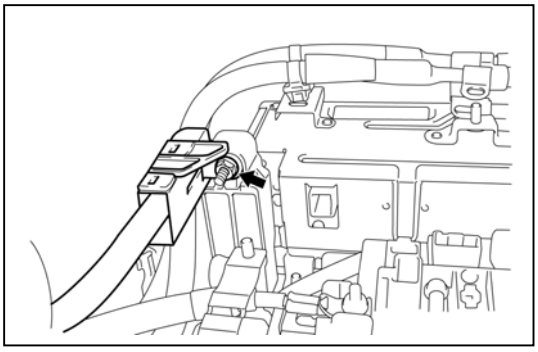


23. Remove the inverter terminal

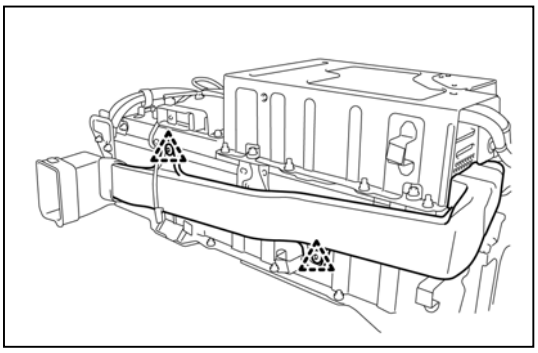
Caution:
Wear insulated gloves.

Notice:
Insulate the terminals of the removed frame wire with insulating tape.

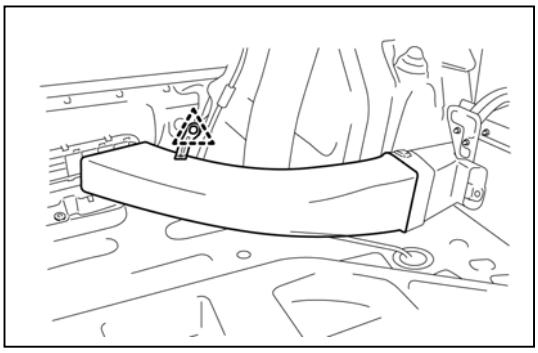
(1) Remove the nut and disconnect the frame wire from the inverter terminal.



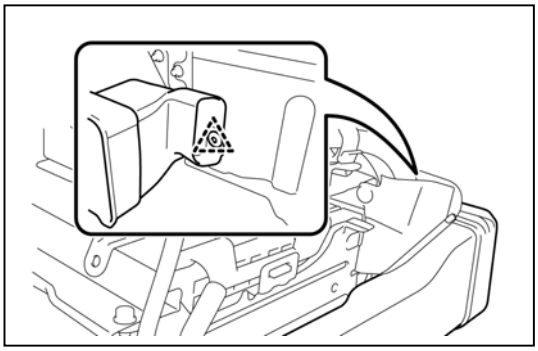
24. Remove the No. 3 hybrid battery exhaust duct.
    (2) Disconnect the 2 clips.



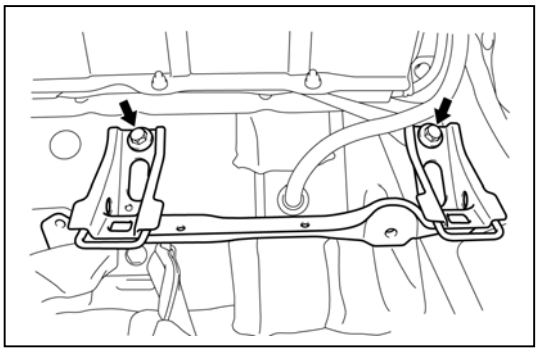
25. Remove the No. 2 hybrid battery exhaust duct
    (1) Remove the clip and No. 2 hybrid battery exhaust duct.



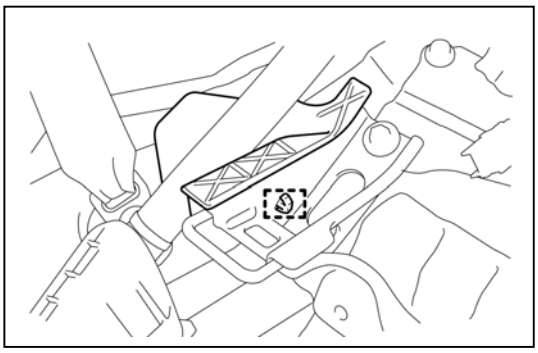
26. Remove the No. 1 hybrid battery exhaust duct.
    (1) Remove the 2 clips and No. 1 hybrid battery exhaust duct.



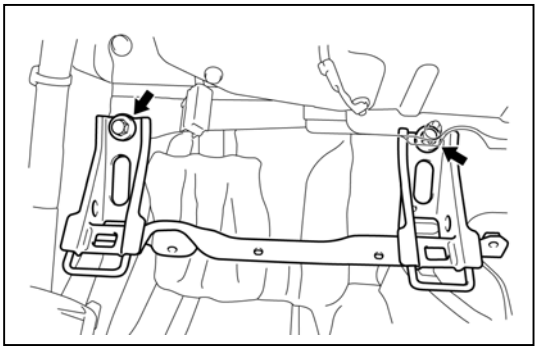
27. Remove the child restraint seat anchor bracket sub-assembly LH
    (1) Remove the 2 bolts and child restraint seat anchor bracket sub-assembly LH.



28. Remove the child restraint seat anchor bracket sub-assembly RH
    (1) Disconnect the wire harness protector clamp.



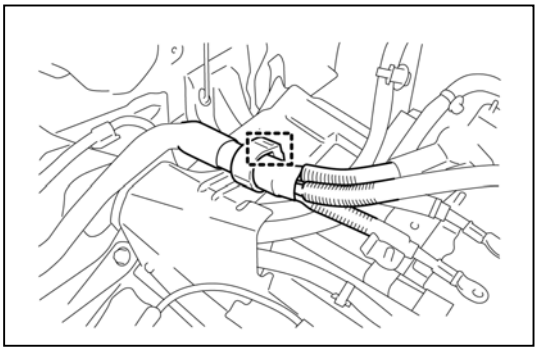
(2) Remove the 2 bolts and child restraint seat anchor bracket sub-assembly RH.



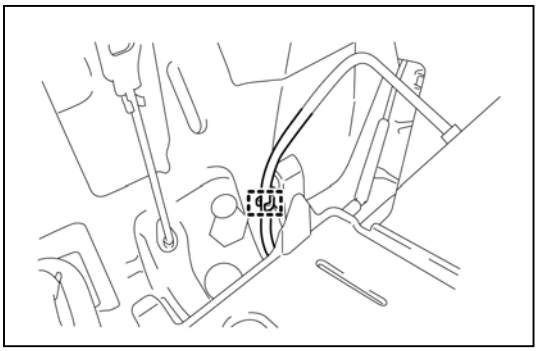
29. Remove the HV battery

Caution:
Wear insulated gloves.

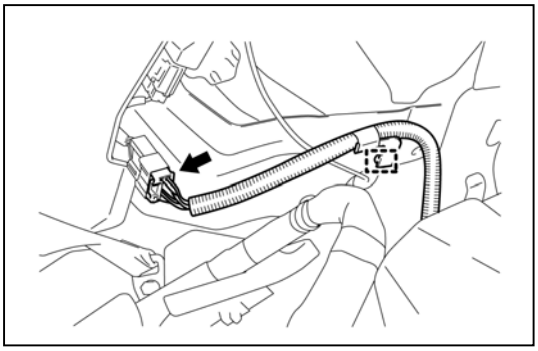
Notice:
Insulate the terminals of the removed frame wire with insulating tape.



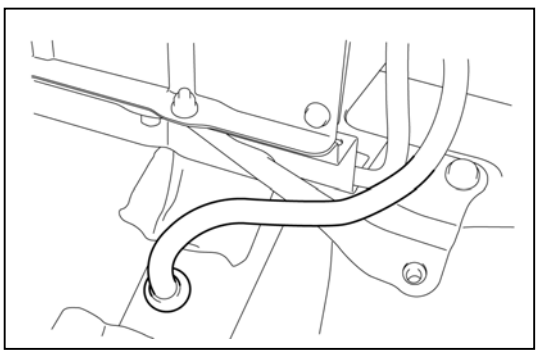
(1) Disconnect the frame wire clamp.



(2) Disconnect the battery room ventilation hose

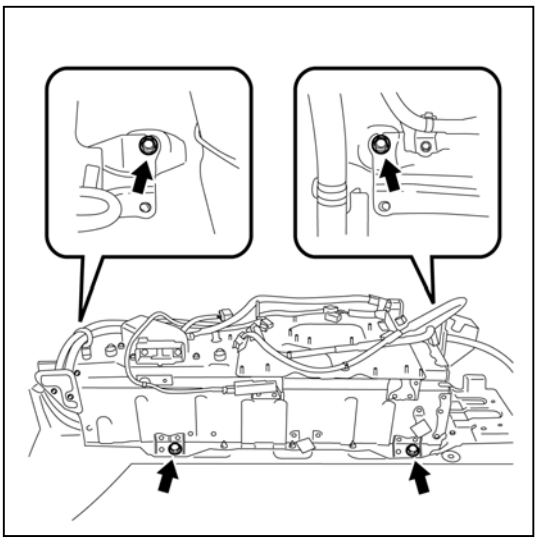


(3) Disconnect the battery pack wire connector and clamp

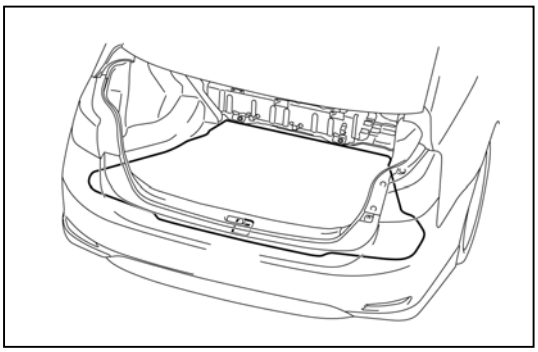


(4) Remove the grommet and hybrid battery hose assembly

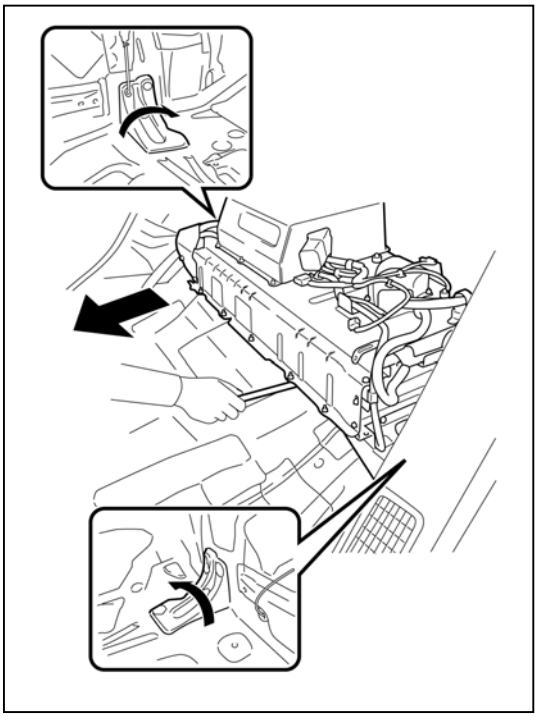
(5) Remove the 4 bolts from the HV battery



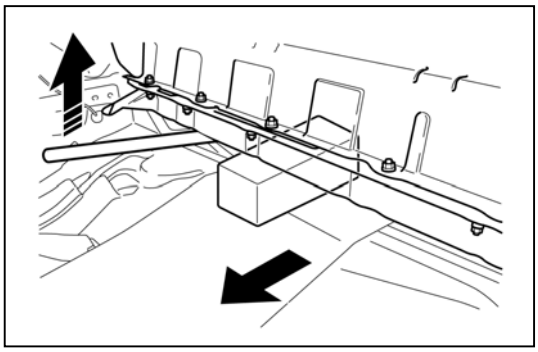
(6) Turn the luggage compartment floor mat over



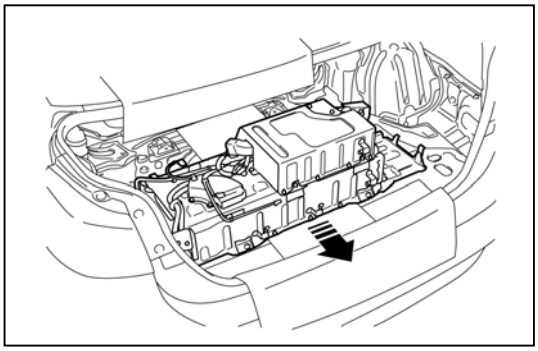
(7) Use a tire lever from the cabin side to lift the HV battery up over the tabs on the body



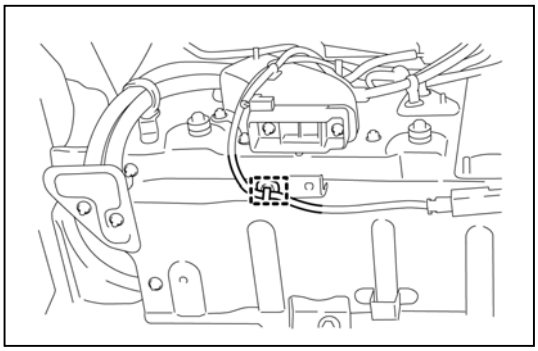
(8) Using a tire lever to hold up the HV battery, insert a wooden block or equivalent as shown in the illustration



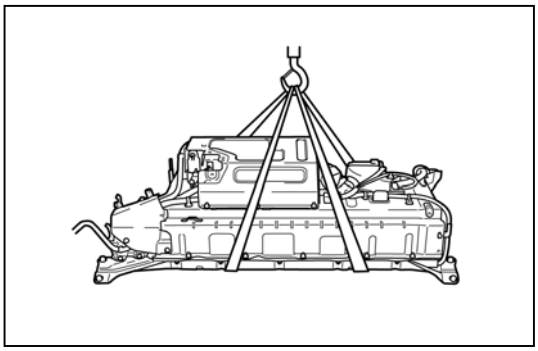
(9) Pull the HV battery together with the cardboard toward the rear of the vehicle



(10) Disconnect the clamp as shown in the illustration

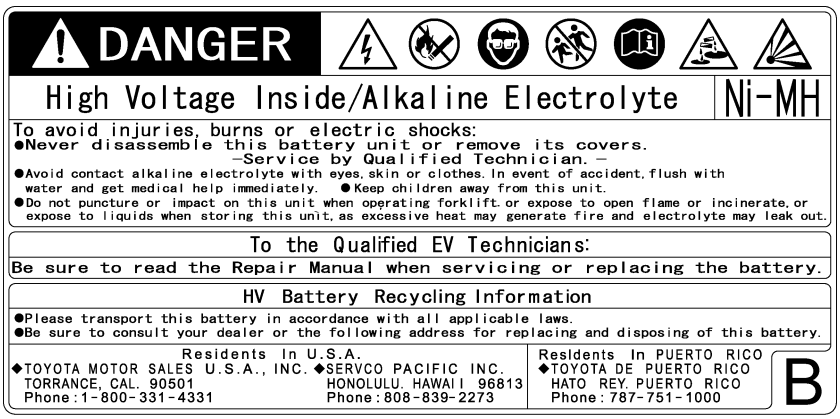


(11) Using a suitable adaptor such as a rope, remove the HV battery while tilting the HV battery



HV Battery Caution Label

1. For U.S.A.



2. For CANADA