1. Precaution

A: CAUTION

Please clearly understand and adhere to the following general precautions for environmental protection and to avoid minor or serious injury to the person doing the work or people in the area.

1. VEHICLE DYNAMICS CONTROL (VDC)

Handle the VDC as a total system. Do not disassemble or attempt to repair individual parts. Follow the directions in this manual when performing maintenance on the VDCCM&H/U. When parts other than those specified are disassembled, it is possible that the VDC system will not operate when needed or cause it to operate incorrectly and result in injury.

2. BRAKE FLUID

If brake fluid gets in your eyes or on your skin, do the following:

• Wash eyes and seek immediate medical attention.

• Wash your skin with soap and then rinse thoroughly with water.

3. RADIATOR FAN

The radiator fan may rotate without warning, even when the engine is not ON. Do not place your hand, cloth, tools or other items near the fan at any time.

4. ACTIVE GRILLE SHUTTER

The active grille shutter may open and close without warning, even when the engine is not ON. Do not place your hand, cloth, tools or other items nearby at any time.

To prevent unexpected deployment, turn the ignition switch to OFF and disconnect the ground cable from battery, then wait at least 30 seconds before starting work. Also, wait at least 30 seconds before starting work after connecting the battery.

5. ROAD TEST

Always conduct road tests in accordance with traffic rules and regulations to avoid bodily injury and interrupting traffic.

6. AIRBAG

To prevent bodily injury from unexpected deployment of airbags and unnecessary maintenance, follow the instructions in this manual when performing maintenance on the airbag components and nearby, around front of the vehicle (radiator panel, front wheel apron, front side frame, front bumper, front hood panel, front fender panel), around side of the vehicle (front door panel, rear door panel, center pillar, rear fender panel, side sill, rear wheel apron), around rear of the vehicle (the rear seat cushion, rear floor pan, rear sub frame assembly) and the airbag wiring harnesses and nearby.

To prevent unexpected deployment, turn the ignition switch to OFF and disconnect the ground cable from battery, then wait at least 60 seconds to discharge electricity before starting work. Removing or installing the components or the connectors with the ignition switch ON will electrically impair them.

7. AIRBAG AND SEAT BELT PRETEN-SIONER DISPOSAL

To prevent bodily injury from unexpected airbag deployment, do not dispose the airbag modules or seat belt pretensioner in the same way as other waste. Follow all government regulations concerning disposal of refuse.

8. AIRBAG MODULE

Adhere to the following when handing and storing the airbag module to prevent bodily injury from unexpected deployment:

• Do not hold the harnesses or connectors to carry the module.

• Do not face the bag in the direction that it opens towards yourself or other people.

• Do not face the bag in the direction that it opens towards the floor or walls.

9. AIRBAG SPECIAL TOOL

To prevent unexpected deployment, only use special tools.

10.WINDOW

Always wear safety glasses when working around any glass to prevent glass fragments from damaging your eyes.

11.WINDOW ADHESIVE

Always use the recommended or equivalent adhesive when attaching glass to prevent it from falling off, resulting in accidents and injury.

12.OIL

When handling oil, adhere to the following to prevent unexpected accident.

• Prepare a container and cloth to prevent scattering of oil when performing work where oil can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.

• Follow all government and local regulations concerning disposal of refuse when disposing.

13.FUEL

When handling and storing fuel, adhere to the following to prevent from unexpected accident.

• Fuel is flammable. Prevent exposure to flames or sparks or any source of ignition.

• Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.

• Follow all government and local regulations concerning disposal of refuse when disposing.

14.ENGINE COOLANT

When handling engine coolant, adhere to the following to prevent from unexpected accident.

• Never remove the radiator cap since engine coolant may blow out when the engine is hot.

• Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the coolant spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.

• Follow all government and local regulations concerning disposal of refuse when disposing.

15.AIR CONDITIONER REFRIGERANT

In order to prevent from global warming, avoid releasing air conditioner refrigerant into the atmosphere. Using a refrigerant recovery system, discharge and reuse it.

16.REMOVAL AND INSTALLATION OPERATION OF HOSES, ETC.

1. Before the removal and installation operation of hoses, etc.

• If you keep using the damaged or deformed hose, it results bleeds or leakage of the fat adheres or disconnection of the hose. Be careful not to spill fat adheres on exhaust pipes, etc. during maintenance to prevent emitting smoke or causing fires.

• Always perform the operation with the hoses removed. If the operation is performed while just putting aside the connected hoses that should be removed in advance, it may damage inner surface of the hose.

2. Removal and installation operation of hoses, etc. during the inspection

• Follow the instructions below when removing hose.

• Do not use a pointed hose remover (hose plucker) when removing a hose. It may damage the inner surface of the hose.



(1) Hose remover

• When removing a hose using pliers, be sure to cover the hose with cloth and rotate the hose slightly to extract straight.

• If you keep using the hose, perform the inspection below and replace the hose with a new part if faulty.

• Replace the hose with a new part if it rides over the stay or the top of spool.



(1) Hose rides over the stay



(1) Hose rides over the top of spool

• Check if the surface and the inner surface of the hose are damaged, cracked, bend, hardened, softened, swollen, peeled or deformed due to the adherence or the entry of the foreign matter by bending the hose. Replace with the new part if faulty.

• Follow the instructions below during installation.

- Check carefully for assembling position.
- Never use lubricants.

• Insert the hose to the specified position (stopper or spool) securely. (The stopper of the spool is between the top of the spool and the bottom section.)





- (1) Push against the spool. (Insert the hose and prevent it from becoming wrinkled.)
- (2) Tighten the hose cramp completely.
- (A) OK position (bottom of spool)
- (B) OK position (top of spool)
- Check if the position, direction and hose layout of the hose clamp are correct. (Check if the position, direction, length and the gap around are correct, or if it is different from the condition before the work.)
- After the installation, check that the hose is installed securely and there is no leakage. (Check if it is fixed securely with the clamp.)

• For hose clips and hose clamps, perform the inspection below and replace them with a new part if faulty.

- Check for deformation, rust, damage or foreign matters.
- For hose clip, check if it works and has clamping force.

• For hose clamp, check if it can be tightened properly, and the band is not deformed.

Precaution

- For hose pipes, perform the inspection below and replace with a new part if faulty. Check if the pipe is not damaged, rusted, peeled (peeled plates included), covered with foreign matter, bent, compressed or cracked.
- For the parts below, replaces with a new part when the hose is removed or the installation position is changed.

CVTF oil cooler hose, fuel hose (delivery) (except for those with quick connector)

17.HANDLING PRECAUTIONS FOR SILICON-CONTAINING SPRAY

When a silicon-containing lubricant is used, rust inhibitor or glazing agent adheres to the electrical contact of the relay or switch, which may produce silica dioxide (SiO₂). This may cause poor connection.

Never spray directly to the electrical equipment.

• When using the spray close to the electrical equipment, always put the cover on the component. Special care must be exercised especially when using the spray to the locations shown in the figure below and their surrounding areas.



- (2) Shift/select lever switch, parking switch
- (4) Stop light switch, brake light switch, clutch switch, clutch start switch

• If the residual silicon remains in the vicinity of the electrical equipment after the spray has been used, the vaporized silicon stands around the electrical equipment and it may adhere to electrical contact. After using the spray, be sure to wipe the silicon off with a cloth.

• Even when using the spray to the place away from the electrical equipment, the droplet of the spray may be splashed to the periphery. Use as small amount of spray as possible, and take care not to splash the silicon to the periphery.

NOTE:

The "silicon" used in this section refers to "silicone", that is, silicon polymer.

B: CAUTION (HYBRID SYSTEM)

1. PRECAUTIONS FOR MAINTENANCE

The hybrid system includes a high voltage circuit. Mishandling may cause electric shocks and leakage. Therefore, perform proper operations by following procedures in this manual.

High voltage caution display

• Before working on the HEV, the vehicle should be marked with a caution sign.

• Copy this page, fold along the perforation and put it on the roof of the vehicle in service before performing any service on the HEV system.

HIGH VOLTAGE CAUTION LABEL



• Only technicians who have received the Subaru training for HEV Systems should be allowed to perform service or maintenance of high voltage circuits.

• All the power cable harnesses and connectors are colored orange. In addition, caution labels indicating [High Voltage] are attached on the High voltage battery and its battery cover. Do not touch the wires and parts related to high voltage without proper Personal Protective Equipment (PPE) and extreme caution.

• Use great care when handling the high voltage system power supply circuits shown in the figure below.



Personal Protective Equipment (PPE)

• Always wear PPE which is in good condition when working on the HEV system. Never touch any high voltage terminals or components without proper PPE.

• Personal Protective Equipment consists of insulated rubber gloves, protective goggles, rubber boots or insulated protective shoes or insulating rubber sheet for the shop floor.

• Always check the insulated gloves for holes or damage before starting work. To check for leaks, create a tight seal around your wrist with the glove gauntlet, and squeeze the glove to confirm that the trapped air does not leak, indicating a hole in the insulating material.



• Never use wet insulated gloves.

NOTE:

Maintenance of the high voltage battery cooling fan and cooling duct parts outside the battery cover, and drive motor control module parts does not require you to wear PPE, even in the compartment, because the voltage is only 12 V.

PPE is not required for maintenance or service of engine compartment and CVT unit. However, orange-colored power cables are excluded.

Operation procedure

In addition to PPE, other precautions must be observed when working on the HEV system since parts with high voltage and strong magnetic force are used.

• Do not carry any metallic products, such as mechanical pencils and rulers, etc. They may be dropped and cause a short circuit.

• Do not wear any metallic objects such as belts or buckles, chains, etc.

• The strong magnetic force can damage or erase magnetic recording media (such as cash cards and prepaid cards), etc.

• Always confirm that the voltage at any high voltage terminal is at 0 V using an insulation multimeter before beginning work.

• To work on the high voltage wire connections, always use insulated tools. If insulated tools are not available, wrap tools with electrical tape for insulation before use.

• When using tools wrapped with electrical tape as alternatives to insulated tools, confirm the insulated condition before working, using a insulation multimeter.

• Make sure to maintain the proper polarity of the positive and negative terminal connections during the high voltage battery removal and installation procedures.

• Never connect the high voltage battery in reverse polarity. Otherwise, the control module will be broken instantly, and other parts will also be damaged.

• Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated, and this voltage may damage electronic parts such as control modules.

• When disconnecting the connectors of the electrical components, always be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors.

• When measuring the voltage or resistance of individual sensor or all electrical control modules, use a tapered pin with a diameter of 0.6 mm (0.024 in) or less and touch it to the tip of terminal. Never insert the tapered pin into the terminal because it deforms inside which may lead to malfunction.

• Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.

• Use the engine ground terminal or engine assembly for the grounding point when measuring the voltage and resistance in engine compartment.

• Use the body ground bolt on the inverter frame as the grounding point, when measuring voltage and resistance in rear of the vehicle.



Precaution

PRECAUTION

• All parts related to the hybrid system are precision parts. Do not drop or otherwise apply impact. Do not reuse the parts that are dropped accidentally.

• Each warning light may illuminate during or after the diagnosis. However, this does not indicate a system malfunction. After the hybrid system diagnosis, perform Clear Memory Mode.

• Take the ignition key or access key out of the vehicle, except when the key is needed inside.

• When the part is replaced or the label is detached, make sure to attach a new label in the original position and direction. Many of the HEV components are labeled with caution warnings.



• This engine starts and stops automatically, when the Hybrid READY indicator light in the meter illuminates. Make sure to turn the ignition to OFF before performing maintenance.

2. SERVICE DISCONNECT PLUG REMOVAL

- Always remove the service disconnect plug before beginning work on the HEV system.
- The ignition must be OFF before removing the service disconnect plug.
 - Turn off the ignition switch and remove the key, or move the access key away from the vehicle.
 Confirm that the READY light is not illuminated.
- 1) Remove the ground terminal from the 12 volt auxiliary battery.

2) For the 12 volt engine restart battery, disconnect the ground terminal from 12V engine restart battery sensor.



(A) 12 volt engine restart battery (B) 12 volt auxiliary battery



4) Remove the service disconnect plug.



(1) Pull up the lever until it touches the stopper.

(2) Move the lever upwards while pressing the claw (a).

NOTE:

The lever locks in the vertical position.

(3) Pull out the service disconnect plug from high voltage battery.

WARNING:

After removing the service disconnect plug, be sure to wait for ten minutes before touching the high voltage connectors and terminals.

NOTE:

Waiting for 10 minutes allows the high voltage condenser in the inverter to discharge.

• Always confirm that the voltage at any high voltage terminal is at 0 V using an insulation multimeter before beginning additional work.

CAUTION:

After removing the service disconnect plug and waiting ten minutes, cover the connection on the battery with electrical tape to protect from intrusion of foreign matter such as water or dust, tools, etc.

• Do not turn the ignition switch ON with the service disconnect plug removed. The system may be damaged.

• After removal, always carry the removed service disconnect plug in your pocket in order to prevent other technicians from accidentally re-installing it while you are working on the system.

• Even after the service disconnect plug is removed, make sure to wear insulated gloves (PPE) during maintenance of all the parts inside the cover including the battery cover, and underfloor power cable.

• Insulate the high voltage power cables, connectors and terminals with electrical tape immediately after removing them.

• Be sure to tighten the high voltage screw terminals firmly to the specified torque. Lack of, or excess torque causes failures.

• Be careful not to allow foreign matter to enter the high voltage battery.

3. INSTALLATION OF THE SERVICE DISCONNECT PLUG

WARNING:

Make sure the connectors are connected completely and locked securely.

• After performing work for the high voltage system, make sure to check again for misplaced parts and tools, tightening conditions of high voltage terminals, and connector connections, before connecting the Service disconnect plug.

• Always replace faulty or damaged Service disconnect plug with a new part.

• If not damaged, always re-use the original Service disconnect plug form the vehicle you are servicing. Never use a Service disconnect plug removed from another vehicle.

Install in the reverse order of removal.

NOTE:

Move the lever to the horizontal position and push it until a click is heard and confirm it is securely locked.

4. PROCEDURES AT AN ACCIDENT SCENE

Preparation items

Protective equipment (insulated gloves, rubber gloves, protective goggles, and rubber boots for electrical purposes)

Saturated boric-acid solution 20 L (In a container, dissolve 800 g of boric acid powder purchased at a drug store in 20 L of water.)

Red litmus paper (purchase at a drug store)

Fire extinguisher (used for both oil fire and electric fire)

Cloth, old towels (for wiping electrolytic solution)

Insulating tape

Circuit tester

• Procedures at an accident scene

Do not touch the exposed wires, when whether they are high voltage wires or not is unknown. When it is necessary or possible to touch them, make sure to wear insulated gloves and insulate the wires using insulating tape.

When vehicle is on fire, extinguish a fire using an electrical fire extinguisher. Attempting to extinguish a fire with a small amount of water may be more of a danger. Therefore, spray a large amount of water from a fire hydrant, or wait for arrival of firefighters.

When the vehicle is submerged in water, do not touch the service disconnect plug and any other high voltage parts and wires due to a possibility of electrical shock. Perform work after completely pulling out the vehicle.

• Check for any leakage in the high voltage battery vicinity.

CAUTION:

• Do not touch any leaked fluid, because it may be strong alkaline electrolytic solution. When it is necessary to touch it, wear insulated gloves and protective goggles, neutralize with saturated boric-acid solution, confirm that red litmus paper does not change to blue, and then wipe off with cloth.

• Do not touch the skin or eyes with rubber gloves with the electrolytic solution (strong alkaline) adhered, because it may cause inflammation and blindness.

• When the vehicle is damaged due to collision, stop the hybrid system in the following steps. 1. Turn the ignition to OFF.

NOTE:

When the ignition cannot be turned to OFF, remove the fuse in engine compartment.

2. Wear insulated gloves and remove the service disconnect plug. <Ref. to PC-10, SERVICE DIS-CONNECT PLUG REMOVAL, CAUTION (HYBRID SYSTEM), Precaution.>

5. MOVING DAMAGED VEHICLE

• When one of the following conditions applies, use a tow truck to move the vehicle.

CAUTION:

Refer to [Towing] for towing procedures. <Ref. to NT-16, TOWING, NOTE, Note.>

High voltage system parts and wires are damaged.

The Hybrid READY indicator light does not illuminate with the ignition at ON.

CAUTION:

Using a tow truck, tow the vehicle with the negative terminal of 12 volt auxiliary battery disconnected, and the service disconnect plug removed. <Ref. to PC-10, SERVICE DISCONNECT PLUG REMOVAL, CAUTION (HYBRID SYSTEM), Precaution.>

• Move the vehicle by driving it, only when towing by a tow truck is unnecessary and there is no problem to drive the vehicle.

CAUTION:

When the hybrid fail lamp illuminates, or abnormal noise, odor, or strong vibration is detected during driving, perform the following procedures.

1. Bring the vehicle to a stop in a safe place.

2. Apply the parking brake.

3. Turn the ignition to OFF and disconnect the negative terminal from 12 volt auxiliary battery.

4. Wear insulated gloves and remove the service disconnect plug. <Ref. to PC-10, SERVICE DISCON-NECT PLUG REMOVAL, CAUTION (HYBRID SYSTEM), Precaution.>

• Procedure after moving damaged vehicle

When there is fluid leakage on the road surface, it may be strong alkaline electrolytic solution. Wear insulated gloves and protective goggles, neutralize with saturated boric-acid solution, confirm that red litmus paper does not change to blue, and then wipe off with cloth.

6. PRECAUTION DURING REPAIR OF DAMAGED VEHICLE

• Preparation items

Protective equipment (insulated gloves, rubber gloves, protective goggles, and rubber boots for electrical purposes)

Saturated boric-acid solution 20 L (In a container, dissolve 800 g of boric acid powder purchased at a drug store in 20 L of water.)

Red litmus paper (purchase at a drug store)

Cloth, old towels (for wiping electrolytic solution)

Insulating tape

Circuit tester

• Precaution during repair of damaged vehicle

CAUTION:

Follow the procedures to ensure safety.

Make sure to use insulated tools, and wear insulated gloves or rubber gloves, protective goggles, and rubber boots for electrical purposes.

Check for any leakage in the high voltage battery vicinity.

CAUTION:

• Do not touch any leaked fluid, because it may be strong alkaline electrolytic solution. When it is necessary to touch it, wear insulated gloves and protective goggles, neutralize with saturated boric-acid solution, confirm that red litmus paper does not change to blue, and then wipe off with cloth.

• If the electrolytic solution should touch the skin directly, immediately wash it away with saturated boric-acid solution or plenty of water. Also, take off the contaminated clothes.

• If it enters your eyes, scream for help, do not rub your eyes, immediately wash it away with plenty of water, and consult a doctor.

Precaution

When the vehicle is damaged due to collision, stop the hybrid system in the following steps.

CAUTION:

Do not touch the exposed wires, when whether they are high voltage wires or not is unknown. When it is necessary or possible to touch them, make sure to wear insulated gloves and insulate the wires using insulating tape.

1. Turn the ignition to OFF.

NOTE:

When the ignition cannot be turned to OFF, remove the fuse in engine compartment.

2. Wear insulated gloves and remove the service disconnect plug. <Ref. to PC-10, SERVICE DISCON-NECT PLUG REMOVAL, CAUTION (HYBRID SYSTEM), Precaution.>

7. PRECAUTION FOR HIGH VOLTAGE BATTERY

Through the route specified by the manufacturer, make sure to collect the high voltage batteries that are no longer needed due to replacement or other reasons.

CAUTION:

• When high voltage batteries are dumped or left without proper measures, electric shock accidents may occur. Be sure to collect the high voltage batteries through the route specified by the manufacturer.

• Do not leave the removed high voltage batteries in a place where water may splash, because generated heat may cause fire.

• When the collision is severe, high impact is applied to the high voltage battery, possibly causing damage inside the high voltage battery. Therefore, visually check the exterior of high voltage battery, and replace with a new one if deformation or such evidence is found at the following locations.



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