

## Section 3 Topics

### Shop Safety

- ▶ Jack and Lift Precautions
- ▶ Exhaust Ventilation
- ▶ Hazardous Materials
- ▶ Safety Equipment
- ▶ Supplemental Restraint Systems
- ▶ High Voltage Systems



- Learning Objectives**
- Identify and use proper procedures for safe lift operation using proper lift points
  - Use proper ventilation procedures for working within the shop area
  - Demonstrate awareness of safety precautions around supplemental restraint systems, hazardous chemicals and materials, hybrid vehicles, and high voltage systems and components

## Jack Precautions

When jacking up the front wheels:

- Release the parking brake
- Place wheel stoppers behind the rear wheels

When jacking up the rear wheels:

- Place wheel stoppers in front of the front wheels

Do not work or leave the vehicle supported only by a jack.

- Be sure to support the vehicle with a safety stand



### Jacking and Lifting Precautions

As a rule, the vehicle should be unloaded before raising it with a jack or a lift. Never jack up or lift the vehicle when it is heavily loaded.

Use caution when removing the engine, transaxle, or other heavy components because the vehicle's center of gravity can shift, and the **vehicle can become unbalanced** and fall. Support the opposite end of the vehicle with a jack stand to prevent it from tipping.

#### Using a Jack

When jacking up the front wheels, release the parking brake and place wheel stoppers behind the rear wheels. When jacking up the rear wheels, place wheel stoppers in front of the front wheels.

Do not work or leave the vehicle supported only by a jack. Be sure to support the vehicle with a safety stand.

## Lift Precautions

### Lifting

- Raise the lift until the lift plates properly contact the vehicle lift points
- Release the parking brake, shut the doors and close the hood
- Raise the vehicle one foot off the ground and check vehicle stability
- Raise the vehicle to working height
- Check locking mechanism is engaged



### Lowering

- Remove any tools left on the lift arms
- Raise the vehicle slightly and disengage the locking mechanism
- Be sure the area is “all clear” before lowering the vehicle
- Lower the vehicle all the way



**Using a Lift** Before using a lift the first time, be sure to read the lift instruction manual. Follow the instruction manual procedures at all times.

When positioning the vehicle on the lift, be sure the vehicle's center of gravity is as close as possible to the center of the lift. The location of the vehicle's center of gravity **can be found in the Repair Manual** under “General: Introduction: Repair Instruction: Vehicle Lift and Support Locations.”

Observe the precautions listed above while lifting and lowering the vehicle.

## Exhaust Ventilation



Automobile exhaust fumes can be harmful or fatal.

For your safety and the safety of others:

- Know how to correctly use the ventilation equipment in your shop
- Use proper ventilation procedures whenever needed



### Exhaust Ventilation

When working with the engine running, make sure to provide ventilation for exhaust fumes in the workshop. Exhaust fumes contain carbon monoxide. Carbon monoxide is an odorless and colorless gas that can be harmful or fatal when inhaled in sufficient quantity.

For your safety and the safety of others, know how to correctly use the ventilation equipment in your shop, and use proper ventilation procedures whenever needed.

## Hazardous Materials

The service bay contains many materials that can be hazardous, including:

- Battery acid
- Brake fluid
- Solvents & degreasers
- Brake dust
- And more



Consult the Material Safety Data Sheets in your shop for proper handling, personal protection requirements and disposal procedures.

### Hazardous Materials

The service bay contains a variety of chemicals and other materials that can be hazardous if not used properly or if used without proper protective equipment and/or ventilation. These hazardous materials may include various petroleum products, acids or other corrosive substances, brake dust, refrigerant and other materials.

For most hazardous materials found in the shop, there should be a Material Safety Data Sheet (MSDS) available that describes:

- What the hazards of the product are
- How to use the product safely
- What to expect if the recommendations are not followed
- What to do if accidents occur
- How to recognize symptoms of overexposure, and what to do if such incidents occur

If you're not certain how to work safely with any potentially hazardous liquids, chemicals or other materials, refer to the MSDS for that product.

## Safety Equipment

Be sure to use the proper personal protective equipment whenever necessary, including:

- Eye protection
- Chemical resistant gloves
- Insulated gloves (for high voltage)
- Respiratory protection
- Ear protection

Know how and when to use other safety equipment provided in your shop, such as:

- Jack stands
- Wheel cages
- Eyewash station



### Safety Equipment

To protect yourself from needless injury, always use the appropriate safety equipment.

- Wear **safety glasses** whenever there is the possibility of eye injury from flying particles or splashed liquids
- Wear chemical resistant **gloves** whenever handling materials that may be corrosive or irritating to the skin
- If qualified to service hybrid vehicle components, you must wear the appropriate **insulated gloves** while servicing the vehicle
- When working in the presence of dust or fumes, wear the appropriate **respiratory protection** (dust mask or respirator)
- When working around loud or noisy tools or equipment, wear appropriate **ear plugs or ear muffs**

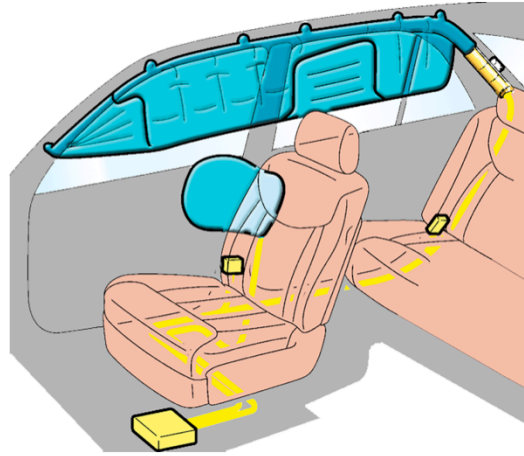
Also, be aware of each item of safety equipment provided in your shop and know how to use it properly, including:

- Jack stands
- Wheel cages
- Eyewash station

## Supplemental Restraint Systems (SRS)

Accidentally deploying an SRS airbag can result in damage or injury.

- Avoid impacts to the airbag sensors
- When using a voltmeter near SRS circuits, be cautious not to short any SRS components
- Do not connect any accessories to SRS wiring



SRS components are identified by yellow wiring or yellow connectors.

### Supplemental Restraint Systems

Even though the service you're performing may not involve the Supplemental Restraint System, there are certain precautions you should observe **to avoid accidentally deploying** an SRS airbag.

- Avoid any impacts to **airbag sensors** that could trigger the airbag
- SRS components are identified by **yellow wiring** or yellow connectors; do not connect any accessories to SRS wiring
- When using a voltmeter near SRS circuits, be careful **not to short** any SRS components



## Hybrid Vehicles

### CAUTION

When a hybrid vehicle is in READY mode, the engine may not be running, but it can start at any time, without warning, **even if the 12-volt battery is disconnected.**



### Hybrid Vehicles

The hybrid vehicle's 12-volt battery does not power a traditional 12v starter. The engine starting system is under the control of the ECU, which uses Motor Generator 1 (MG1) to crank the engine for starting. Even when standing still, if the vehicle is in the READY mode **the engine will start automatically** when the HV battery needs charging.

### CAUTION

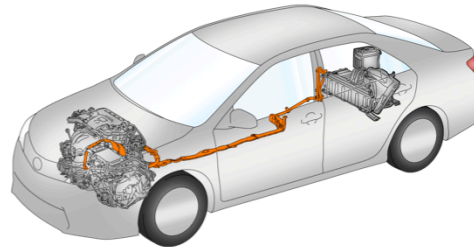
- When performing service in the engine compartment, be sure the vehicle is NOT in READY mode
- If it is necessary to work in the engine compartment with the vehicle in READY mode, exercise extreme caution around any parts that may suddenly begin moving when the engine starts



## High Voltage Hybrid Vehicle Systems

The hybrid vehicle system operates at up to 650 volts.

- If system components are not handled correctly, there is a risk of serious injury or electrocution
- Before servicing any hybrid system components, you must obtain certification in hybrid systems



- All hybrid system high-voltage wire harnesses are **orange**
- The HV battery and other high-voltage components have **High Voltage** caution labels
- Do not carelessly touch these wires or components

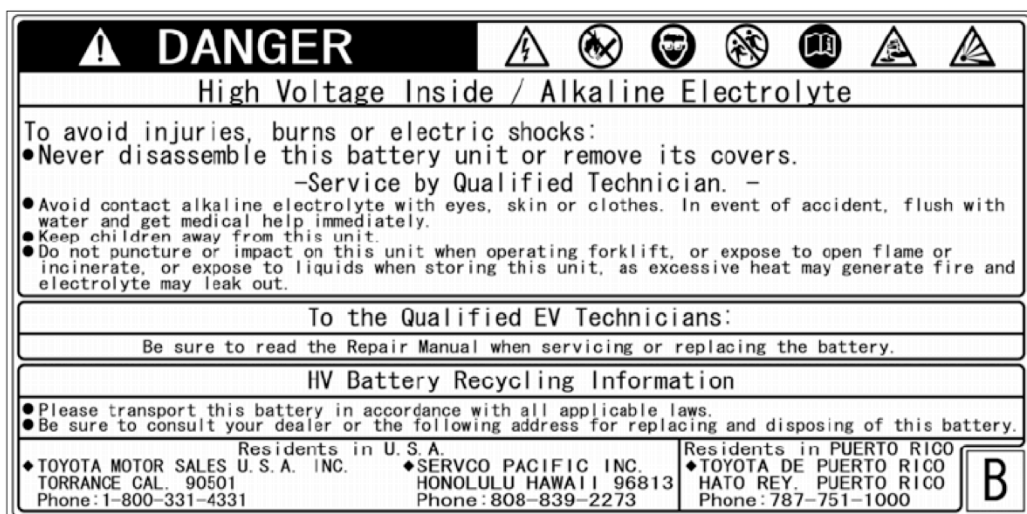
### High Voltage Hybrid Vehicle Systems

The hybrid system includes high-voltage circuits that can carry up to 650 volts. Incorrect handling of high-voltage circuits or components can cause explosions, severe burns, or electric shock that **may result in death or serious injury**.

You **must be certified in hybrid systems** before attempting to service any hybrid system circuits or components.

High-voltage circuits are identified by **orange colored wiring**. When servicing or repairing other systems or components in a hybrid vehicle, be careful not to accidentally touch any of the high-voltage circuits or components.

## Hybrid Battery Warning Label



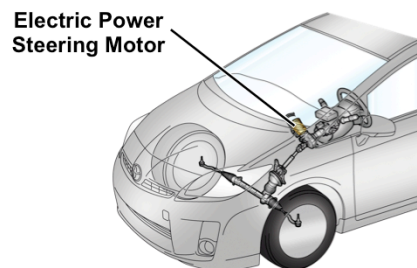
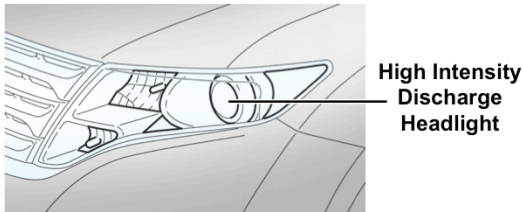
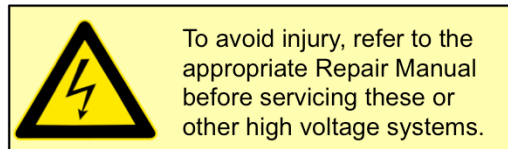
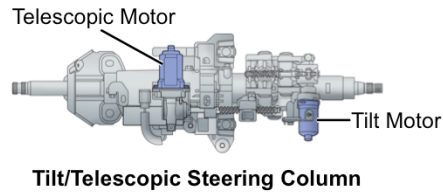
### Hybrid Battery Warning Label

Know where the hybrid battery is located in the vehicle and avoid contact with it. Do not attempt any service to the hybrid battery unless you are certified in hybrid vehicle service.

## Other High Voltage Systems

Some non-hybrid vehicle systems operate above 12v and are potentially hazardous:

- Electronically controlled brake (ECB) systems
- High intensity discharge (HID) lamps
- Ignition secondary circuits
- Fuel injection systems
- Electric power steering
- Tilt/telescopic steering column motors
- Air conditioning compressors (in some hybrid models)



### Other High Voltage Systems

Besides hybrid vehicle circuits, there are other circuits in some vehicles that **operate above 12 volts**, as listed above.

In some of these systems, the operating voltage may range from **30 to 40 volts** (electric power steering, for example), to **as high as 20,000 volts** (HID headlights when they are first illuminated).

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