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TECHNICAL BULLETIN No. 3/2004

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SUBJECT

Extrication considerations for the Toyota Prius (Hybrid Vehicle) – An update

Note: This technical bulletin is an update of 01/2001 and covers additional risks to rescuers found in the Series 2 Prius as well as modified recommended procedures from Toyota.

INTRODUCTION

In October 2001 Toyota released series one of a new motor vehicle, the "Prius" (pronounced 'Pree-us') similar in size to a Toyota Corolla. In late 2003 Series two of the same vehicle was released with slight modifications. The vehicle is a 'hybrid' vehicle that utilises both a petrol engine and an electric motor to create greater fuel efficiency and reduce green house gas emissions. Honda also released a similar vehicle called the Insight in 2001.

Toyota Prius Series 1

Toyota Prius Series 2

Honda Insight

Two energy sources are stored on board the vehicle, petrol for the combustion engine and a high voltage battery pack for the electric motor. There is also a low voltage (12V) battery to operate traditional electrical systems on board the vehicle and assist with starting the petrol motor.

The high voltage electrical system varies in the vehicles as follows:

Toyota Prius Series 1	273 Volts (commonly referred to as 300V)
Toyota Prius Series 2	201 Volts (200V)
Honda Insight	144 Volts

SIGNIFICANT DIFFERENCES FROM NON-HYBRID VEHICLES

1. If the ignition key is on and the 'ready' light on the instrument panel is on, the petrol motor could start at any time to charge batteries or perform other functions that require additional power.
2. If the 'Ready' light is on, the transmission is in drive or reverse and the petrol motor is not running, the vehicle will still move if the accelerator pedal is depressed and no noise made. That is, the vehicle could be quiet capable of moving under motor power even though there is no noise coming from under the bonnet.

In view of these issues there are some precautions that will need to be taken in the instance of rescue crews attending extrication calls involving such a vehicle. These include:

- A modified incident approach in order to identify whether the vehicle is hybrid;
- Identification of potential hazards associated with the vehicle; and
- Implementation of necessary actions to minimise risk to rescuers and casualties during extrication from a hybrid vehicle.

IDENTIFICATION OF THE PRIUS

External markings

(Series 1)

- "Hybrid" badge on passenger side boot lid
- "Prius" badge on drivers side boot lid

(Series 2)

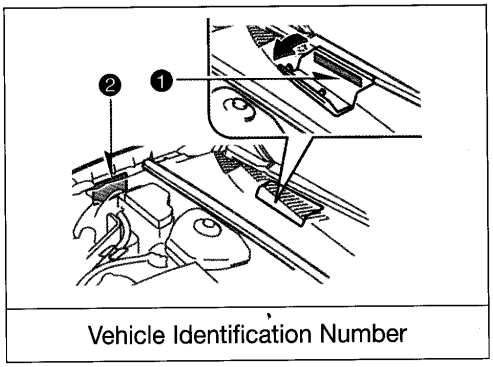
- "Prius Hybrid Synergy Drive" badge on drivers side boot lid

Under bonnet

- "Hybrid" label on inverter
- Vehicle identification number (on driver's side bulkhead) begins with "JT753FU" for Series 1 and "JTDKB2" for Series 2 vehicles

Series 1

Series 2



Vehicle Identification Number

1. VIN plate
2. Manufacturer's plate

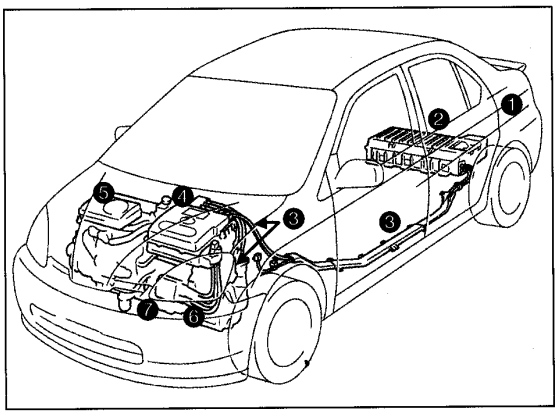
Note Series two vehicles may have the VIN plate located on passenger side B pillar.

Interior

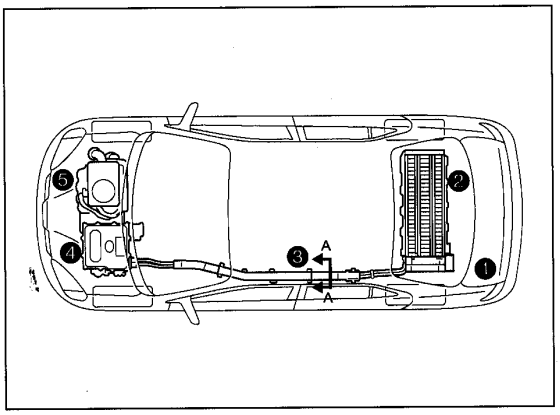
- Unusual location of gear shift lever (extending from the dash board to the left of the steering column). Note that it is less obvious on the Series 2.
- Modified instrument panel with two displays (Series 1 both centrally mounted, Series 2 one central and one over the steering column).

Series 1

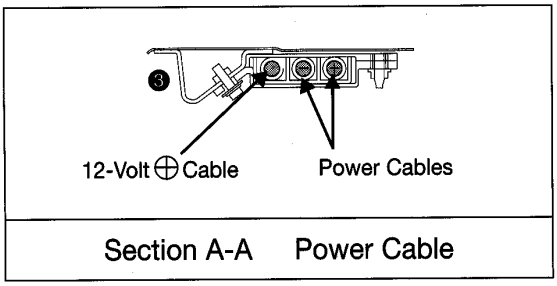
Series 2



Component parts
1. 12V battery.
2. High voltage battery pack.
3. Power cables.
4. Inverter.
5. Petrol engine.
6. Electric motor.
7. Electric generator.



Under chassis
- Orange high voltage cables under plastic conduit

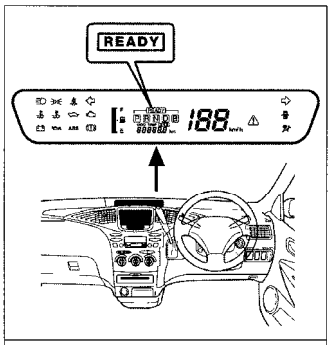


Section A-A Power Cable

In boot
- Area behind rear seat and between rear wheel arches is taken up with high voltage battery. This is located under the boot trim mat.
- 12V battery located passenger side behind rear wheel arch and is normally covered by trim and carpet.

INCIDENT APPROACH

When rescue crews arrive on scene, normal incident approach procedures should apply. In addition team members should:



Instrument Cluster **READY** Indicator

- Confirm using the identification information if the vehicle is a hybrid.
- If hybrid, check to see if the 'ready' light on the instrument panel is illuminated. **This indicates the vehicle is ready to drive even though the engine may be silent.**
- Beware of the additional hazards which are
  - high voltage (up to 300 volts depending on make and model).
  - large battery between rear wheel arches.
  - battery contents is a strong caustic alkaline electrolyte (pH 13.5) which could leak in a very destructive collision.
- Be aware that the Series 1 vehicle has usual driver and front passenger air bags and seat belt pre-tensioners including optional front seat mounted side entry air bags with sensors mounted in the B pillars. In addition, Series 2 vehicles have optional roof mounted side impact curtain airbags. **Note that these curtain airbags are operated by a gas cylinder, not sodium azide, which is also located in the roof lining above the B pillar.**
- Ensure all other ESO personnel and salvage operators on scene are aware that the vehicle is a hybrid.


Side impact curtain and gas cylinder assembly shown laid in position over the top of the actual installation in the roof lining.

RISK MANAGEMENT

Prius Series 1

To render the scene safe, rescue crews must:

- Chock wheels.
- Set park brake. Note: the Prius Series 1 park brake is a 'push on/push off' foot pedal located between the transmission tunnel and foot brake.
- Place transmission in park.
- **Turn ignition key off and remove to isolate high voltage system and ensure motor cannot start. Note: after disabling power is maintained for 90 seconds in the SRS and for 5 minutes in the high voltage system.**
- Ensure 'Ready' light is <u>not</u> illuminated before commencing extrication.

- Disconnect, and remove, if possible, 12V battery located in boot compartment.
- **Note the removal of the high voltage service plug from high voltage battery pack in boot is no longer recommended. However, if this is the only 'render safe' option then insulated rubber gloves for electrical work must be used.**
- If the engine key is not accessible, an alternate option is to remove the high voltage fuse and relay in the engine compartment. If in doubt, remove them all.
- Never cut any orange high voltage cables or open any high voltage components.

Prius Series 2

To render the scene safe, rescue crews must:

- Chock wheels.
- Set park brake. Note: the Prius Series 2 park brake consists of two components, the foot pedal similar to the Series 1 and a push button (labelled 'P') on the dash to the left of the steering column. Ensure the light comes on after pressing the button.

- Place transmission in park.
- Push the Power button to the right of the steering column and confirm the 'Ready' light is not illuminated.
- Remove the ignition key to a distance of at least 5 metres from the vehicle. The ignition key for the Series 2 is a small electronic device similar to an alarm immobiliser and is inserted into a slot between the steering column and the 'Power' button. **Note: after disabling power is maintained for 90 seconds in the SRS and for 5 minutes in the high voltage system.**

- Ensure 'Ready' light is not illuminated before commencing extrication.
- Disconnect, and remove, if possible, 12V battery located in boot compartment.
- **Note the removal of the high voltage service plug from high voltage battery pack in boot is no longer recommended. However, if this is the only 'render safe' option then insulated rubber gloves for electrical work must be used.**
- If the engine key is not accessible, an alternate option is to remove the high voltage fuse and relay in the engine compartment. If in doubt, remove them all.
- Never cut any orange high voltage cables or open any high voltage components.

FURTHER INFORMATION & REFERENCES

- Toyota web site at http://www.toyota.com.au
- Toyota, 'Prius Gasoline-Electric Hybrid Emergency Responder Guide', October 2001
- Toyota, 'Prius Petrol-Electric Hybrid Synergy Drive Emergency Responder Guide, 2003
- Fox, Timothy, Station Officer, NSW Fire Brigades: 'Gone west … in a green machine!', Fire News (NSW Fire Brigades Publication), March 2003.

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