

July 15, 2015

DEFECT INFORMATION REPORT

1. Vehicle Manufacturer Name:

Toyota Motor Corporation [“TMC”]
1, Toyota-cho, Toyota-shi, Aichi 471-8571, Japan

Affiliated U.S. Sales Company

Toyota Motor Sales, USA, Inc. [“TMS”]
19001 South Western Avenue, Torrance, CA 90501

Supplier of the inverter assembly

Toyota Motor Corporation--Hirose Plant

Country of Origin: Japan

2. Identification of Involved Vehicles:

Based on production records, we have determined the involved vehicle population as in the table below.

Make/ Car Line	Model Year	Manufac- turer	VIN		Production Period
			VDS	VIS	
Toyota/ Prius V	2012 - 2014	TMC	ZN3EU	C3010274 – E3359159 EJ000103 – EJ007949	August 22, 2011 through June 30, 2014

Note: (1) Although the involved vehicles are within the above VIN range, not all vehicles in this range were sold in the U.S.

- (2) No other Toyota or Lexus vehicles use the same inverter assembly and software used to control the boost converter in the motor/generator control electronic control unit (ECU) as the involved vehicles.

3. Total Number of Vehicles Potentially Involved:

108,624

4. Percentage of Vehicles Estimated to Actually Contain the Defect:

Unknown

5. Description of Problem:

The inverter assembly is part of the hybrid system of the subject vehicle. Inside the inverter assembly is an Intelligent Power Module (IPM) which contains a control board equipped with transistors known as Insulated-Gate Bipolar Transistors (IGBT's). In a specific usage condition the software that controls the boost converter in the IPM could cause microscopic voids to build up in the solder beneath the IGBTs used for the operation of the boost converter. If this occurs, the heat dissipation ability of the IGBT could be reduced, causing the IGBT to be damaged. If the IGBT is damaged, it could result in the illumination of various warning lights on the instrument panel. In most cases, the vehicle will enter a fail-safe mode, resulting in reduced motive power in which the vehicle can still be driven safely for certain distances. In limited instances, the motor/generator ECU could reset, causing the hybrid system to shut down and resulting in the vehicle stopping while being driven, increasing the risk of a crash.

6. Chronology of Principal Events:

February 2014 – August 2014

Toyota received a field report from the Japan market for a Prius V indicating a popping noise and the vehicle not accelerating, along with illumination of the warning light. Toyota examined the returned inverter assembly and found damaged IGBT(s) on the side of the control board used for operation of the boost converter. This was similar to the inverters recalled on certain Prius vehicles starting in early February 2014 (recall 14V-053). At that time, the Prius V was investigated and found not to be affected by the condition that was the subject of this recall.

Based on the knowledge obtained in the previous recall investigation, the solder beneath other IGBT's surrounding the damaged IGBT was inspected. However, there was no evidence of cracking in the solder as seen in the previously recalled inverters. The driving behavior by the customer was reviewed, but no abnormal usage of the vehicle which could result in the damaged IGBT was found. Toyota reviewed the production process and confirmed that there were no changes to the production process which could possibly lead to damage of the IGBT for Prius V.

In June 2014, Toyota received the first dealer report from the U.S. market indicating illumination of the warning light and a no "Ready On" condition. The Prius V inverter was returned and investigated. A damaged IGBT for the boost converter was found. Toyota conducted replication testing with the conditions utilized during the testing on the Prius' inverter in which the deformation of the IGBT exceeded the destruction limit of the IGBT, however no damage of the Prius V IGBT was observed.

September 2014 – January 2015

To identify the cause of the damaged IGBT, Toyota recovered inverters from in-use vehicles and inspected the IGBTs. Deformation was found on the surface of IGBTs in some of the recovered IPMs, which could potentially lead to the damage on the IGBT. Toyota looked for hairline cracks in the solder, which was observed in the inverters on the previously recalled Prius vehicles, but no such hairline cracks were observed in the Prius V solder. Toyota further conducted a detailed analysis in the solder by nondestructive examination and found microscopic voids in the solder near the IGBT.

February – early July 2015

Toyota continued its investigation, focusing on the microscopic voids, including analysis of the mechanism of void occurrence and replication testing. It was found through laboratory testing that voids in the solder may build up if the vehicle is not operated for a long period of time after the IGBT used for operation of the boost converter reaches its maximum temperature. If this occurs, the heat dissipation ability could be reduced at a local portion of the IGBT, causing the IGBT to become deformed, eventually resulting in damage to the IGBT. If the IGBT becomes damaged, the hybrid system may go into the fail-safe mode, which allows the vehicle to be safely operated at reduced speeds. However, it is also theorized that, in limited instances, the motor/generator control ECU, which sits on top of the IPM, could be exposed to electrical transients generated by large current flowing through the boost converter, causing a specific microchip in the ECU to reset itself, resulting in the hybrid system shutting down rather than going into the fail-safe mode.

July 9, 2015

Based on the above investigation, Toyota decided to conduct a voluntary safety recall campaign on the subject vehicles.

As of July 7, 2015, Toyota is not aware of any crashes or injuries caused by this condition. Two Toyota field reports and 62 warranty claims have been received that relate or may relate to this condition. Multiple counts of the same incident are counted separately.

7. Description of Corrective Repair Action:

All known owners of the subject vehicles will be notified by first class mail to return their vehicles to a Toyota dealer to have the software updated for both the motor/generator control ECU and the hybrid control ECU. If an owner experiences a failure of the boost converter IGBT before the vehicle receives updated software, the dealer will repair the inverter or replace the inverter assembly with a new one at no charge.

Reimbursement Plan for pre-notification remedies

The owner letter will instruct vehicle owners who have paid to have this condition remedied prior to this campaign to seek reimbursement pursuant to Toyota's General Reimbursement Plan.

8. Recall Schedule:

Notifications to owners will begin late July 2015. A copy of the draft owner notification letter(s) will be submitted as soon as it is available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers will be sent on July 14, 2015. Copies of dealer communications will be submitted as they are issued.