

**Toyota Motor Engineering &
Manufacturing North America, Inc.**

Vehicle Safety & Compliance
Liaison Office
Mail Code: S-104
19001 South Western Avenue
Torrance, CA 90501

RECEIVED

By Recall Management Division at 9:11 am, Sep 04, 2013

September 4, 2013

Ms. Nancy Lummen Lewis
Associate Administrator for Enforcement
National Highway Traffic Safety Administration
Attn: Recall Management Division (NVS-215)
1200 New Jersey Ave, SE
Washington, D.C. 20590

Re: Certain Toyota Highlander Hybrid and Lexus RX400h Inverters
Part 573, Defect Information Report

Dear Ms. Lewis:

In accordance with the requirements of the National Traffic and Motor Vehicle Safety Act of 1966 and 49 CFR Part 573, on behalf of Toyota Motor Corporation ["TMC"], we hereby submit the attached Defect Information Report concerning a voluntary safety recall of certain Toyota Highlander Hybrid and Lexus RX400h vehicles to address an issue with the hybrid inverters.

Should you have any questions about this report, please contact me at (310) 468- 8555.

Sincerely,



Abbas Saadat
Vice President
Toyota Motor Engineering & Manufacturing
North America, Inc.

Enclosures
Part 573, Defect Information Report

DEFECT INFORMATION REPORT

1. Vehicle Manufacturer Name:

Toyota Motor Corporation ["TMC"]

1, Toyota-cho, Toyota-city, Aichi-pref., 471-8571, Japan

Affiliated U.S. Sales Company

Toyota Motor Sales, USA, Inc. ["TMS"]

19001 South Western Avenue, Torrance, CA 90501

Manufacturer of Hybrid Inverter Assembly:

DENSO CORPORATION

1-1, Showa-cho, Kariya-city, Aichi-pref., 448-8661, Japan

Telephone: + 81-566-25-5511

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/ Highlander HV	2006 - 2010	TMC	#W##A	60001012 - 60033951 70016487 - 70050064 82000108 - 82025892 92025893 - 92037778 A2037352 - A2048651	February 16, 2005 through July 29, 2010
Lexus/ RX400h	2006 - 2008	TMC	#W31U	60001007 - 60049412 62000103 - 62007397 72000995 - 72039945 82005871 - 82071867 82850001 - 82867597	February 23, 2005 through December 2, 2008

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

The vehicles within the above VIN range which received a replacement of the inverter assembly in the 2011 recall (11V-342) are not involved in this recall.

No other Toyota or Lexus vehicles use the same hybrid inverter as the subject vehicles.

3. Total Number of Vehicles Involved:

Toyota Highlander HV:	79,629
Lexus RX400h:	53,452
Total:	133,081

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). Due to variation in characteristics of IGBT's built in parallel circuits, which are used for operation of the motor or generator, higher operating temperatures exceeding the allowable temperature of the lead-based solder underneath the specific IGBT(s) could occur. If this occurs, the solder could degrade and eventually cause heat damage to the IGBT(s), illuminating 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 for short distances. In limited instances, the fuse of the power supply circuit could blow, 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:

June 2011 – June 2012

In June 2011, Toyota initiated a voluntary recall campaign (11V-342) concerning inverter failures on 2006-2007MY Toyota Highlander HV and Lexus RX400h vehicles. These vehicles were equipped with inverters produced at a particular Toyota plant or inverters containing IGBT's produced at this same plant. Both inverters were manufactured with voids in the solder causing reduced heat dissipation of the IGBT. At that time, Toyota had received a few field technical reports from the U.S. and Japan markets indicating illumination of warning lights or fail-safe mode operation followed by no-start condition on vehicles outside the scope of the above recall. These vehicles were equipped with inverters which had no problems concerning voids in the solder caused by the previous manufacturing issue.

Investigation of the inverters returned along with the field technical reports found damaged IGBT(s); however, no evidence of voids or cracking in the solder, as seen in the previously recalled inverters, in any of the IGBT's surrounding the damaged IGBT. Toyota and the supplier reviewed the production process and design change histories. It was confirmed that there were no changes to the production process or design which could possibly lead to damage of the IGBT.

July 2012 – November 2012

Toyota recovered inverters from in-use vehicles for further investigation. It was found that there was a difference in thermal resistance between parallel circuits containing IGBT's. Detailed investigations focusing on the parallel circuits with higher thermal resistance revealed that these circuits had wider variation in certain characteristics between IGBT's used, such as electrical resistance and/or on/off timing of the IGBT. It was theorized that this variation between IGBT's could affect the thermal resistance of certain IGBT's, possibly resulting in the higher thermal resistance of the parallel circuit.

December 2012 – May 2013

Toyota conducted replication testing and confirmed that, if one IGBT in a parallel circuit had lower resistance and/or faster-on/slower-off timing compared to the others in the same circuit, electrical current could concentrate on this specific IGBT, causing the operating temperature of the IGBT to unexpectedly rise. In order to verify the possibility of IGBT damage caused by increased temperature, Toyota conducted further replication testing.

June 2013 – Late August 2013

As a result of further testing, it was found that, if the operating temperature of an IGBT exceeds the allowable temperature of the lead-based solder used to install the IGBT to the substrate, the solder could deteriorate, causing the heat dissipation ability of the IGBT to reduce and potentially resulting in heat damage to the IGBT. It was also confirmed that inverters using lead-free solder, such as the ones used as remedy parts in the previous recall, will not have this problem, because lead-free solder has a much higher allowable temperature, which prevents the solder from degrading due to heat.

August 29, 2013

Based on the above investigation, Toyota decided to conduct a voluntary safety recall campaign on the subject vehicles to replace the IPM in the inverter assembly.

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 or Lexus dealer for replacement of the IPM with an improved one using lead-free solder.

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 the owners will begin in late September 2013 and be completed in late October 2013. Copies of the draft owner notification will be submitted as soon as it is available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers will be sent in early September 2013. Copies of dealer communications will be submitted as they are issued.