TOYOTA

**Toyota Motor North America, Inc.**

Vehicle Safety & Compliance
Liaison Office
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6565 Headquarters Drive
Plano, TX 75024

June 26, 2019

# 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 North America, Inc. ["TMNA"]
6565 Headquarters Drive, Plano, TX 75024

Manufacturer of DC-DC converter:

Toyota Industries Corporation
2-1, Toyoda-cho, Kariya-city, Aichi-pref., 448-8671, Japan
Phone: +81-566-22-2511

Country of Origin: Japan

2. Identification of Involved Vehicles and Affected Components:

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

| Make/Car Line | Model Year | Manufacturer | Production Period |
|---|---|---|---|
| Toyota / Prius C | 2018-2019 | TMC | February 6, 2018 through October 4, 2018 |

| Applicability | Part Number | Part Name | Component Description |
|---|---|---|---|

| | | | |
|---|---|---|---|
| MY2018-2019 Toyota Prius C | G9201-52013 | Case Sub-Assy, with Converter | DC-DC Converter |

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

(2) This issue only affects the vehicles equipped with a DC-DC converter that uses a circuit board which may have been manufactured under the specific conditions described in this report. Other Toyota or Lexus vehicles sold in the U.S. are not equipped with those DC-DC converters.

3. Total Number of Vehicles Potentially Involved:

464

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

Approximately 10%

Toyota estimates that approximately 10% of the vehicles have the potential to develop the solder separation condition over the lifetime of the vehicle, which could lead to the unreasonable risk to safety described below.

5. Description of Problem:

The hybrid system of the subject vehicles includes a DC-DC converter that reduces the voltage of the electricity from the HV battery in order to charge the auxiliary battery. Due to improper maintenance of specific pallets and pins used for the circuit board soldering process at a supplier, there is a possibility that, when combined with a certain production variation, the soldering of a specific transistor to the circuit board in the DC-DC converter could be inadequate and separate after temperature cycling of solder under normal vehicle operation. As a result, the auxiliary battery may no longer receive power from the DC-DC converter, causing warning lights to illuminate, audible chimes to sound, and messages to display on the instrument panel. If the vehicle is continuously operated in this condition and the auxiliary battery is discharged to a certain level, the hybrid system could shut down, resulting in loss of motive power. Loss of motive power while driving at higher speeds could increase the risk of a crash.

6. Chronology of Principal Events:

July, 2018 – January, 2019

In July 2018, Toyota received a field technical report from the Japan market indicating that

warning lights illuminated on a Toyota Aqua vehicle and the vehicle would not accelerate when moving out of a parking space. The dealer inspected the vehicle and found illumination of warning lights and a DTC indicating failure of the DC-DC converter, which is a component inside the inverter. The inverter from this vehicle was recovered and investigated. It was found that solder applied to a terminal of a transistor on the circuit board in the DC-DC converter had separated.

Due to the low mileage of the reported vehicle, Toyota hypothesized that a manufacturing error could have caused the solder separation, and the supplier began an investigation of the soldering process for the circuit board during manufacture. Investigation results revealed that the pallet which holds the circuit board during soldering had significant deformation (outside of the specification for the acceptable range of deformation to a pallet). At this point, the supplier inspected their pallets that were being used for this process and identified that two additional pallets used in the same process had a similar out-of-specification condition. These three pallets were eliminated from the soldering process.

Because the supplier process includes checking for deformation of the pallets periodically, the supplier began investigating the cause of the observed pallet deformation by interviewing the operators who were responsible for pallet maintenance and inspection of the pallets. It was determined that the operator performing this function at this time was improperly checking for pallet deformation.

Based on this information, duplication testing was conducted to identify whether the solder separation at the terminal of the transistor on the circuit board observed in the field case could be created by the pallet deformation that existed in the three pallets mentioned above. The testing showed that this pallet deformation could not create the observed solder separation.

The supplier continued its investigation, reviewing the production history and conducting additional interviews with the operator. It was found that the operator responsible for maintaining the soldering equipment and checking for pallet deformation had changed in February 2018. Further, the investigation identified that, during maintenance, this operator is also responsible for making adjustments to the position of the pins in the pallets, which must be adjusted periodically to ensure its correct position is maintained. The further investigation found that these pins had also been improperly adjusted.

Duplication testing was again conducted to identify if there is a possibility that the solder separation at the terminal of the transistor on the circuit board observed in the field case could be created by the aforementioned pallet deformation in combination with the incorrect pin position. In this testing, it was observed that the solder at the terminal of the transistor had partially peeled. To identify if the same solder separation observed in the field case could occur on parts which have partially peeled solder, a heat cycling durability testing was conducted, but no expansion of the peeling which could lead to the solder separation was observed.

February, 2019 – June, 2019

The investigation was continued to identify any other factors which could lead to the solder separation. It was found that stress on the circuit board at the terminal of the transistor becomes larger if the circuit board is placed in a specific position in one of the three deformed pallets. Duplication testing was conducted, and it was identified that the solder at the terminal of the transistor could peel substantially if the circuit board was soldered by using one of the aforementioned pallets with the incorrectly positioned pins and the circuit board is placed in a specific position in the pallet. Based on the above findings, heat cycling durability testing was conducted, using circuit boards produced under these conditions, to observe if the same solder separation as the failed part could occur. Under these conditions, the solder separation could be duplicated. In addition, Toyota had recovered inverters to determine if there was a possibility that circuit boards soldered using pallets other than the three identified with significant deformation can experience the separation of solder of the terminal of the transistor. Through this activity Toyota observed that circuit boards which were soldered from one of the three deformed pallets exhibited peeling, whereas circuit boards which were soldered using other pallets exhibited no peeling.

As a result of the aforementioned investigations, Toyota concluded that, if a circuit board was soldered by using one of the three aforementioned deformed pallets with the incorrectly positioned pins and the circuit board is placed in a specific position in the pallet, the solder could separate after temperature cycling of solder under normal vehicle operation. In this condition, the auxiliary battery may no longer receive power from the DC-DC converter, causing warning lights to illuminate, audible chimes to sound, and messages to display on the instrument panel. If the vehicle is continuously operated in this condition and the auxiliary battery is discharged to a certain level, the hybrid system could shut down, resulting in loss of motive power.

June 20, 2019

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

As of June 19, 2019 based on a diligent review of records, Toyota's best engineering judgment is that there are 1 Toyota Field Technical Reports and 12 warranty claims that have been received from U.S. sources that relate or may relate to this condition and which were considered in the decision to submit this report.

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. For all involved vehicles, based on the vehicle identification number or an inspection, the dealer will replace the affected DC-DC converter with a new one,

if necessary, at no cost.

Reimbursement Plan for pre-notification remedies

As the owner notification letters will be mailed out well within the active period of the Toyota New Vehicle Limited Warranty ("Warranty"), all involved vehicle owners for this recall would have been provided a repair at no cost under Toyota's Warranty.

8. Recall Schedule:

Notifications to owners of the affected vehicles will occur by Mid-August, 2019. A copy 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 on June 26, 2019. Copies of dealer communications will be submitted as they are issued.

10. Manufacturer's Campaign Number:

[Interim / Remedy] K1K / K0K