TOYOTA

Toyota Motor Engineering & Manufacturing North America, Inc.

Vehicle Safety & Compliance
Liaison Office
19001 South Western Avenue
Torrance, CA 90501

November 15, 2017

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

Manufacturer of the Electric Vehicle Fuse :

Pacific Engineering Corporation
450 Hinoki cho, Ogaki City, Gifu, 503-0981, Japan
Telephone: +81-584-91-3131

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 PHV	2012 - 2015	TMC	July 20, 2011 through January 8, 2015

Applicability	Part Number	Part Name	Component Description
MY2012 - 2015 Toyota Prius PHV	G3829-47040 G3829-47041	Fuse, Electric Vehicle	EV Fuse

(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) The affected vehicle production period is from the start of production of this model until the final vehicle which contains the subject EV (Electric Vehicle) fuse.
(3) Other Toyota or Lexus hybrid vehicles sold in the U.S. use a fuse of a different design to protect the hybrid system from potential damage. Other Toyota and Lexus vehicles sold in the U.S. are not equipped with a hybrid system.

3. Total Number of Vehicles Potentially Involved:

39,915

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

Unknown. Toyota is unable to provide an estimate of the percentage of vehicles to actually contain the defect. Whether the issue in each case will lead to a hybrid system shutdown, creating an unreasonable risk to safety, depends on each vehicle's operating conditions over time.

5. Description of Problem:

The subject vehicles are equipped with a Plug-in hybrid system which contains a hybrid battery with an EV (Electric Vehicle) fuse that is designed to protect the system from potential damage. There is a possibility that excessive thermal stress could be generated in the fuse if the vehicle is operated by the electric motor under high-load driving conditions, such as during a long ascent. If this were to occur repeatedly, the fuse could develop a fracture that could cause the fuse to open. In this condition, electric power would not be supplied to the electric motor from the battery, illuminating warning lights and warning messages on the instrument panel. In some cases, the vehicle can be driven, but with reduced power. In other cases, the hybrid system could shut down, resulting in the loss of motive power. Power steering and braking will not be affected. Loss of motive power while driving at higher speeds can increase the risk of a crash.

6. Chronology of Principal Events:

August 2014 - February 2015

In August 2014, Toyota received a field technical report from the European market indicating that a Prius PHV allegedly experienced illumination of warning lights, loss of motive power, and the vehicle would not enter "Ready-on." The vehicle was inspected by the dealer and, based on the dealer's diagnosis, the hybrid battery was thought to be the cause of the alleged failure and was replaced. Toyota examined the returned hybrid battery and found the EV fuse in the hybrid battery, which is designed to protect the system from potential damage, had a fatigue fracture at the fusing point of the fuse element. Toyota theorized that the EV fuse had received unanticipated damage during manufacturing.

Toyota examined the manufacturing process and conducted a parts review to determine if other fuses could be affected. No abnormalities were found in production parts during this review. However, it was theorized that, while manufacturing the fuse, there is a possibility that the fuse element could be mishandled and bent at the fusing point. Although the possibility existed, there was no evidence during the manufacturing process review that mishandling occurs. Nonetheless, duplication testing was conducted by using an EV fuse with an element that had been bent for the purpose of the test and a fatigue fracture could be duplicated. Toyota theorized that, if bending and damage occurred to the fuse element, it could reduce durability of the fusing point, leading to a fatigue fracture.

However, because the production process did not specify handling the fuse element in any manner that would bend the fuse element, and due to the limited number of warranty claims and other field information, Toyota believed that the possible occurrence of a bent element during the manufacturing process would be rare. At this time, the work procedure was updated to include specified handling procedures for the fuse to avoid possible bending of the fuse element during production. Additionally, the shape of the element was changed to prevent concentration of stress and possible bending at the fusing point.

March 2015 – June 2017

Toyota sporadically received additional reports from the U.S. market alleging the vehicles would not enter "Ready-on" or were experiencing stall while driving. Toyota initiated an investigation into the returned fuses of six vehicles. Four of the fuses showed evidence that the fuse had melted and fractured. Toyota considered that these fuse fractures were not the result of a possible manufacturing issue such as bending of the fuse element.

Toyota theorized that an excessive current could be a cause of the fuse fracturing. Toyota investigated the driving conditions of the vehicles with fractured fuses to see if there were any conditions under which an excessively large current was generated. It was observed that, after reviewing the vehicles' drive patterns, most of the vehicles investigated were operated frequently on a slope and/or a highway. In consideration of these driving conditions, drive testing was performed with test vehicles, and Toyota was able to duplicate a high load diving condition (e.g., driving up hill or on a highway that generated a large current close to the maximum current controlled by the system). However, Toyota was unable to identify any driving pattern which lead to a melting fracture.

July 2017 - Early November 2017

In July 2017, Toyota received a field technical report from the Japan market indicating a vehicle stopped at an intersection and lost motive power. The investigation on the returned fuse found a melting fracture. An interview of the customer identified that they usually attempt to drive the vehicle under electric power only. Toyota conducted drive testing on the same route the customer normally used and recorded vehicle operation history data in the test vehicle. The drive pattern Toyota was simulating was driving at low speeds on an ascent using the electric motor. Data analysis revealed that an excessively large current, which may cause the immediate melting of the fuse element, could not be observed. However, the data indicated a large current flow was generated for an unexpectedly long period of time. Duplication testing was then conducted by applying a longer maximum controlled current repeatedly for a long

period of time to simulate the aforementioned driving pattern. As a result, a fatigue fracture of the fuse could be duplicated. In addition, Toyota confirmed that, if high voltage is applied to the fuse at the time it fractures, a melting fracture could occur. At this point, it appeared that the fatigue fracture and the melting fracture were attributable to the same cause and showed a pattern of failure.

Thus, it was confirmed that, if a large current flow repeatedly occurred for a long period of time (e.g., under regular high load driving conditions), the element could expand and shrink by the heat generated by the current flow. This could lead to high thermal stress in the fuse element and cause the element to fracture. In this condition, the fuse could open and electric power would not be supplied to the electric motor from the battery, illuminating warning lights and warning messages on the instrument panel. In some cases, the vehicle can be driven, but with reduced power. In other cases, the hybrid system could shut down, resulting in the loss of motive power. Power steering and braking will not be affected.

November 9, 2017

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

As of November 6, 2017, based on a diligent review of records, Toyota's best engineering judgement is that there are 2 Toyota Field Technical Reports (including 1 unconfirmed field technical report) and 151 warranty claims (including 102 unverified claims) that have been received from U.S. sources that relate to, 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 involved vehicles will be notified by first class mail to return their vehicles to a Toyota dealer. Toyota dealers will replace the EV fuse with a new one of an improved design.

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 of the affected vehicles will occur by early-January, 2018. A copy of the draft owner notification letter will be submitted as soon as available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers were sent on November 14, 2017. Copies of dealer communications will be submitted as they are issued.

10. Manufacturer's Campaign Number:

H0R