TOYOTA

Toyota Motor Engineering & Manufacturing North America, Inc.

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

June 1, 2017

DEFECT INFORMATION REPORT

1. Vehicle Manufacturer Name:

Toyota Motor Manufacturing, Texas, Inc. [“TMMTX”]
1 Lone Star Pass, San Antonio, Texas 78264

Toyota Motor Manufacturing de Baja California, S. de R. L. de C.V. [“TMMBC”]
Carretera Tijuana Tecate Kilometro 143 y 144
Tijuana, Baja California C. P. 22550

Affiliated U.S. Sales Company

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

Manufacturer of Crankshaft Rotor

A.J. Rose Manufacturing Co.
38000 Chester Road, Avon, Ohio 44011
Telephone: +1-440-934-7700

Country of Origin: USA

Manufacturer of Crank Position Sensor

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 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/Tacoma	2016 - 2017	TMMTX TMMBC	September 17, 2015 through October 28, 2016

Part Number	Part Name	Component Description
19315-0P040	Plate, Crank Angle Sensor	Crankshaft rotor
90919-05089	Sensor, Crank Position	Crank position sensor

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) Only vehicles equipped with a V6 engine (2GR-FKS) manufactured September 15, 2015 through November 30, 2015 are affected; other engines are not affected.

(3) MY2016 and MY2017 Lexus RX vehicles produced at Toyota Motor Manufacturing Canada, Inc. and MY2017 Highlander and Sienna vehicles produced at Toyota Motor Manufacturing Indiana, Inc. are equipped with the same engine with the crankshaft rotor produced by the same supplier in the U.S. However, these vehicles are equipped with an updated crank position sensor which will be used as a remedy part for this recall campaign.

In addition, MY2016 and MY2017 Lexus GS vehicles produced in Japan and sold in the U.S. are equipped with the same engine assembled in Japan. These engines contain the same crankshaft rotor produced by a different supplier in Japan with a different coating.

(4) No other Toyota or Lexus vehicles sold in the U.S. utilize the same crankshaft rotor and position sensor combination.

3. Total Number of Vehicles Potentially Involved:

31,824

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

Unknown

5. Description of Problem:

The crank position sensor in the subject vehicles uses a magnetic resistance element to monitor the position of the rotor (i.e., the reluctor wheel) mounted to the engine crankshaft. Some of the V6 engine crankshaft rotors may have been produced with an anti-corrosion coating containing a greater concentration of silica, which increases the coating thickness. This may cause potential interference with the crank position sensor during normal vehicle operation. The interference could generate a static charge, which could result in a crank position sensor malfunction. In this condition, the vehicle may display a Malfunction Indicator Light (MIL) on, misfire, or, in some instances, stall under a variety of conditions. If the vehicle stalls while driving at higher speeds, it may increase the risk of a crash.

6. Chronology of Principal Events:

January 2016 – March 2016

In January 2016, Toyota received a field technical report from the U.S. market indicating a 2016 Toyota Tacoma equipped with a V6 engine had stopped running while the vehicle was stopped. Toyota inspected the vehicle and was able to duplicate the condition by allowing the vehicle to idle for a period of time. During this inspection, a variety of engine diagnostic trouble codes were identified. It was also observed that the data output (waveform) from the crank position sensor ("sensor") appeared abnormal. Toyota was unable to identify abnormalities in the sensor or crankshaft rotor ("rotor") that would explain the abnormal sensor signal.

Toyota received other field reports from the U.S. market and investigated recovered parts; warranty claims were also received. A nonconductive material, similar to the sealant (formed-in-place gasket) used during the engine assembly process, was observed on the sensor tip. Toyota theorized that this sealant may come into contact with the sensor tip during installation of the sensor and/or with the rotor tooth during engine operation, causing the sealant to transfer to the sensor tip and causing a static charge to be generated on the sensor tip, leading to an abnormal sensor signal. Toyota conducted an engine assembly process inspection and determined that there is a possibility that extra sealant may remain on the engine if sealant was not removed properly or sufficiently during engine assembly. An improvement was made to the process at the engine assembly plant. In addition, an updated sensor of an improved design, which is more resistant to static charge, was implemented to match how this engine is incorporated into other vehicles.

Based on additional field reports, Toyota inspected vehicles, focusing on abnormal sensor signals. No sealant was observed on the rotor tooth or the sensor tip. Thus, it was unclear whether the sealant was leading to the abnormal sensor signal. However, a white material flaking on the rotor tooth was observed in some vehicles. Toyota conducted further investigation on the white material on the rotor tooth and its influence on the sensor signal. Toyota reviewed the rotor supplier's process and confirmed that this material is the anti-corrosion coating ("coating") applied to the rotor during manufacturing.

April 2016 – September 2016

Toyota received field reports indicating a variety of conditions, including MIL on, engine running rough, or engine stall during different driving scenarios. Toyota conducted additional investigations, attempting to identify a possible defect by duplicating an abnormal signal by using a recovered engine assembly, which included bench tests and actual vehicle tests. However, these tests were unable to duplicate an abnormal sensor signal. Toyota also measured the gap between the sensor tip and rotor tooth of the recovered engine, but no abnormality was observed.

Toyota theorized that flaking of the coating on the rotor may cause abnormal sensor signals. Toyota investigated the rotor supplier's process again and found that no abnormal process changes which may lead to flaking of the coating had occurred. However, it was found that the concentration of silica, which is a component of the coating, had varied over time within the supplier's specification. It was noted that warranty claims were focused on rotors produced during the periods when the concentration of silica was high. To further investigate whether the concentration of silica affects coating flaking, Toyota produced rotors with coatings containing various concentrations of silica and conducted coating flaking duplication testing. However, coating flaking could not be duplicated. In addition, further review of the recovered rotors from confirmed cases showed that most rotors did not have evidence of flaking. Thus, it appeared that an abnormal sensor signal could not be produced through flaking of the rotor coating, and it was not clear what factors could produce the abnormal sensor signal.

October 2016 –May 2017

Toyota continued to recover parts, including sensors, rotors, and engine assemblies for inspection. No flaking of the crankshaft rotor coating was observed on these recovered rotors, and the sealant (formed-in-place gasket) used during the engine assembly process had no application abnormalities. However, some sensors, which were recovered from engines

produced in October through November 2015, showed superficial scratch marks on the sensor tip.

Toyota investigated the potential presence of a defect by duplicating the possible contact between the sensor tip and the rotor tooth which may create scratch marks as observed in recovered parts. Testing was conducted in order to account for assembly tolerance, thermal expansion of engine components, and dynamic motion. Toyota found that the gap between the sensor tip and the rotor tooth could decrease by thermal expansion and dynamic motion; however, these tests were unable to duplicate the contact condition. Toyota conducted testing to determine whether a reduced gap could cause abnormal sensor signal, but no abnormal signal was observed.

Toyota conducted an additional review of the engine and rotor production process, considering the production periods of engines recovered from the field with superficial scratch marks on the sensor tip. No engine assembly and rotor production concerns were identified except for the higher concentration of silica in the rotor coating during the period of September through October 2015 at the rotor supplier. By correlating both the production period of the recovered parts with superficial scratch marks and the increasing trend in warranty claims with the production period of the higher concentrations of silica, Toyota theorized that the combination of the higher concentration of silica and thermal expansion could create the contact between the sensor tip and the rotor tooth which could generate a static charge on the sensor tip.

Toyota again produced rotors with coatings made under various concentrations of silica and measured the coating thickness. It was found that the higher concentrations of silica in the coating increased the coating thickness. Increased coating thickness could reduce the gap between the sensor tip and the rotor tooth during vehicle operation. If the concentration of silica exceeds a certain value, the rotor coating could interfere with the sensor tip under certain thermal expansion conditions, thus showing a possible way for a static charge to be generated on the sensor tip. Static charge of the sensor tip may result in an abnormal signal, which could cause the engine to run roughly or stall.

May 26, 2017

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

As of May 17, 2017, based on a diligent review of records, Toyota's best engineering judgment is that there are 34 Toyota Field Technical Reports reporting some type of stalling and other

conditions, and 1,181 warranty claims, most of which are unverified, that have been received from U.S. sources that relate to MIL-On, misfire, and/or stalling under a variety of conditions which were considered in the decision to submit this report. 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. Dealers will replace the crank position sensor with one of an improved design. This remedy will be at no cost to owners.

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 will begin by mid-July, 2017. A copy of the draft owner notification letter will be submitted as soon as available.

9. Distributor/Dealer Notification Schedule:

Notifications to distributors/dealers will be sent on June 1, 2017. Copies of dealer communications will be submitted as they are issued.

10. Manufacturer's Campaign Number:

H0H