U.S. Department of Transportation
National Highway Traffic Safety Administration

OFFICE OF DEFECTS INVESTIGATION

ODI RESUME

Investigation: PE21005
Prompted By: VOQ Review
Date Opened: 02/25/2021 **Date Closed:** 08/12/2024
Investigator: Matthew Martens **Reviewer:** Gregory Magno
Approver: Tanya Topka
Subject: Battery Hold Down Bracket Thermal Events

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Toyota Motor Corporation
Products: 2013-2018 Toyota RAV4
Population: 1,862,103

Problem Description: The 12V battery B+ terminal shorts to the battery hold down frame which may result in the sudden loss of electrical power, vehicle stalling, and/or a fire originating in the engine compartment.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	EWR D&I	Other	Total	EWR Field Reports
All Incidents:	104	62	2	0	155*	CONF
Crashes/Fires:	101	62	0	0	152*	CONF
Injury Incidents:	1	7	0	0	8	0
Number of Injuries:	1	7	0	0	8	CONF
Fatality Incidents:	0	0	0	0	0	0
Number of Fatalities:	0	0	0	0	0	0

Description of Other:

*Total eliminates duplicates received by the manufacturer

ACTION/SUMMARY INFORMATION

Action: This Preliminary Evaluation (PE) is closed with a manufacturer recall 23V-734.

Summary:

The Office of Defects Investigation (ODI) opened a Preliminary Evaluation (PE) to understand the contributing factors and frequency of vehicle fires originating from the battery region of the engine compartment in Model Year (MY) 2013-2018 Toyota RAV4 vehicles on 25 February 2021. At the time of opening, ODI attributed eleven allegations and additional EWR events to this PE. PE21005 focused on replacement batteries installed in the subject vehicles. No reported fire event identified in PE21005 involved the originally supplied 12V battery. The reported fires took place in vehicles known to contain aftermarket batteries or whose age exceeded the expected life of the original equipment battery. ODI identified battery dimensioning as it relates to the battery retention system (hold down bracket, radiator support bolt, J-hook, and battery tray) as the main factor set in the contact between the battery hold down bracket contacting the positive terminal of the 12V battery.

The subject vehicles carried over the same battery tray and retention system from the prior generation (MY2006 – MY2012) of RAV4 vehicles. However, the subject vehicles were equipped with a dimensionally smaller battery (Group 35) than the prior generation (Group 24F). The smaller- length measurement in the Group 35 battery size in a battery tray originally designed to fit a Group 24F battery contributed to increased potential for battery movement which was exacerbated by the diversity in aftermarket battery configuration and irregularities intrinsic to battery replacement procedures. Battery movement coupled with the proximity of the B+ terminal on the battery and the grounded electrically conductive hold down bracket set the stage for a short to ground leading to an engine stall (if in operation) followed by a vehicle fire. This investigation was not able to classify the installation status, battery size, or cause of every allegation due to the fire event causing damage to the area, inaccessible vehicle, modification to the battery retention system after the event, and/or inconclusive photographic evidence.

Toyota's investigation of the issue identified aftermarket battery catalogs that listed an improper battery replacement size (Group 26R) that would nevertheless fit into the subject vehicles whose battery retention system is incapable of reliably restraining a Group 26R battery. On 18 November 2021, Toyota initiated a consumer advisory campaign (21TG01) to the subject vehicle owners, notifying them of the correct size battery and offering a free inspection of the battery and retention hardware, a caution label to affix to the hold down bracket, and a discounted replacement 12V battery.

This investigation with Toyota established three broad categories to characterize the battery retention system state of a given vehicle: "correct", "minor mis-installation", and "major mis-installation".

- The "correct" terminology references the front bolt, bracket, and J-hook installed in a position not in contact with the positive battery terminal and the front bolt torqued to 17 Nm and the J-hook engaged with the tray hole and torqued to 4.9 Nm.
- A "minor mis-installation" would describe the three retention components installed in the prescribed location, however not to the correct torque values.
- The "major mis-installation" condition would constitute a retention component missing or disconnected from the system.

Toyota's own testing used five exemplar batteries installed on a subject vehicle in each battery categorization resulted in:

- Contact between the B+ terminal and hold down bracket in "major mis-installations"
- Movement of the battery in "minor mis-installations"
- No observable motion in "correct" installations.

ODI conducted its own evaluation of the Toyota- specified replacement battery and 5 aftermarket Group 35 batteries. The six batteries tested conformed to the Group 35 Battery Council International (BCI) standard on overall dimensional tolerance and terminal location. That standard

does not define the edge shape or material of battery casing. Physical interaction between the hold down bracket and the battery case and the friction between the casing material and the battery tray resulted in a large variability in movement forces required to incite movement when the battery was installed in the "correct" condition. Resulting in movement at an induced lateral load between 0.6 G and 1.91 G equivalent force across each battery. This force is higher than a typical vehicle could exert in a steady state turn and would only experience loads through brief shock or impulses. Multiple shock or impulse loads across time would contribute to a delay between the replacement battery installation and the fire event. Likelihood of a fire event increases as the installation method degraded from the "correct", to "minor mis-installation", and then to "major mis-installation". Protruding vent caps atop some of the batteries tested aided in restricting battery movement relative to the hold down. An absence of vent caps permitted additional movement.

Following several discussions and vehicle inspections with ODI during this investigation, on 01 November 2023, Toyota filed a safety recall (NHTSA 23V-734) of 1,853,568 MY 2013 through MY 2018 Toyota RAV4 vehicles to reduce the risk of a vehicle fire with redesigned battery retention components. To review the ODI reports cited in the Closing Resume ODI Report Identification Number document, go to NHTSA.gov.