

## FORD MOTOR COMPANY (FORD) RESPONSE TO PE24-002

Request 14

Furnish Ford's assessment of the alleged defect in the subject vehicles, including:

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that it poses;
- e. What warnings, if any, the operator, and the other persons both inside and outside the vehicle would have that the alleged defect was occurring, or subject component was malfunctioning; and
- f. The reports included with this inquiry.

Answer

National Highway Traffic Safety Administration (NHTSA) Office of Defects Investigation (ODI) opened this Preliminary Evaluation based on Vehicle Owner Questionnaire (VOQ) reports alleging loss of motive power in certain model year (MY) 2021 Ford Bronco Sport vehicles. While there is a broad definition of the alleged defect and subject component in the Information Request, based on conversations with NHTSA, Ford understand the alleged defect to be a loss of motive power while either driving or after coming to a stop accompanied by a failure in the electrical system. Ford has investigated this subject, including the cause of these reports, the circumstances under which they occur, and the anticipated performance of the subject and peer vehicles and subject components related to these reports (12-volt battery, alternator, starter motor, battery junction box, and battery wiring).

A Bronco Sport vehicle's electrical system is designed to meet specific fuel economy standards, and, to do so, there are certain conditions during a drive cycle where the alternator output can be reduced to near zero amperes. During these conditions, the system relies on the 12-volt battery to provide the necessary output to meet the vehicle's electrical demand. If during the drive cycle the 12-volt battery experiences a failure causing it to drop out of circuit, the vehicle's electrical loads will not be supported, and will require the alternator to react to provide current. If the alternator cannot ramp up quick enough to maintain the required system voltage above 6.5 volts, the vehicle may experience a loss of motive power without advanced Low Battery Warning from the Body Control Module (BCM). The warning indicator is triggered when the 12-volt battery drops below 68% state of charge (SOC).

A major causal or contributing factor is that the existing calibrations used to detect a 12-volt battery with a low SOC is unable to detect an abrupt battery failure. Engineering analyses at the system and vehicle level revealed that the Body Control Module (BCM) and Powertrain Control Module (PCM) calibrations are unable to detect an abrupt battery failure, which can result in a LOMP if the alternator is unable to keep up with the electrical load demand. This primarily manifests during auto stop/starts.

Ford employs a battery management sensor (BMS) to monitor the SOC of the 12-volt battery. The BMS measures the output voltage during engine crank and vehicle ignition "on", and if the output voltage is not within operating conditions, a visual alert warning will be displayed in the instrument panel cluster. This is known as the Charging System Service Soon warning (BCM). It requires power to execute and serves to warn the driver of the battery state. The BMS was

not designed to monitor the current state of charge of the 12-volt battery during a drive cycle and cannot detect if the battery has degraded significantly during the drive cycle or experienced a catastrophic failure.

The tear-down and evaluation of a 12-volt battery that had experienced a failure in the field revealed heavy internal corrosion that is indicative of long exposures to high heat environments. The specific battery failure was attributed to corrosion related growth of the positive battery plates, eventually shorting themselves on either the cast on strap (lead (Pb) busbar) or onto the negative plates (see generally Figure 1). The condition of the failed battery points to a conclusion that the failure event occurs quickly.

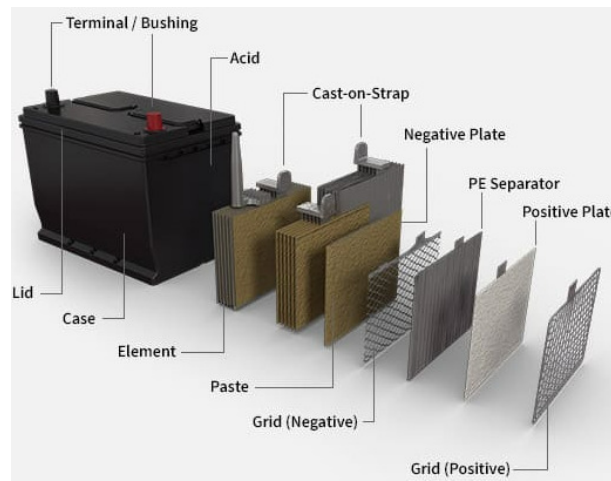


Figure 1. Generic Example of Enhanced Flooded Battery

If the vehicle does not detect a sudden loss of battery voltage while driving leading to a loss of motive power while coming to a stop, the driver will still be able to perform braking and steering functions. Once the vehicle's speed falls below 5 MPH, the transmission will automatically engage the park pawl, resulting in a ratcheting noise. When the vehicle reaches a stop, the transmission will be locked in park gear, preventing a vehicle rollaway condition.

If the vehicle does not detect a sudden loss of battery voltage while driving and allows an auto stop/start event to occur, the vehicle may not restart when the brake pedal is released.

If one of these conditions occurs, customers will not receive an advance warning of a battery failure, and 12-volt accessories may no longer operate if the battery fails, including hazard lights. A loss of motive power can increase the risk of a crash.

Ford is providing an analysis of the reports included in this inquiry. First, Ford reviewed the 31 vehicle owner questionnaire (VOQs) provided by NHTSA and found that 17 claims were responsive to the A1 category and were repaired with a 12-volt battery replacement and 1 claim in the A2 category resulted in an alternator replacement. The three B1 claims were ambiguous and did not have enough information for a category assessment. The 10

remaining VOQs were not considered responsive since either their symptoms did not match the focus of this investigation, or the root cause was related to a component(s) not included in the list of potential subject components.

Second, Ford completed a thorough review of model year 2021-2023 Bronco Sport vehicle customer and field claims related to the alleged defect of loss of motive power and have summarized the findings into the following categories:

<b>Category</b>	<b>Definition</b>
A1	Loss of motive power while driving, no electrical power, no restart – battery replacement
A2	Loss of motive power while driving, no electrical power, no restart – other subject component replaced (starter, alternator, wiring)
B1	Loss of motive power while driving - ambiguous (not clear if it is related to the subject components)

Ford developed its assessment of this concern after completing its investigation and by preparing the response to this Information Request. To summarize, Ford's current assessment is that an insufficient calibration strategy for detecting sudden battery degradations during a drive cycle can lead to a vehicle that is unable to restart after an auto start/stop event or experience a stall while coming to a stop at low speed. The data analysis indicates that the inability to restart after an auto start/stop event is the most common scenario. While 12-volt batteries of various performance and quality will likely be replaced multiple times during a vehicle's life, enhanced detection and warning strategy on the vehicle should prevent a LOMP condition from occurring when a battery does fail abruptly.