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

OFFICE OF DEFECTS INVESTIGATION

ODI RESUME

Investigation: EA23002
Prompted By: PE22007
Date Opened: 09/29/2023
Date Closed: 10/31/2024
Investigator: Joseph Teitelman
Reviewer: Peter Kivett
Approver: Tanya Topka
Subject: Loss of Motive Power

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Ford Motor Company
Products: Model Years 2021-2022 Ford Bronco, Edge, Explorer, and F-150 and Lincoln Aviator and Nautilus vehicles
Population: 411,315

Problem Description: Under normal driving conditions without warning the vehicle may experience a loss of motive power without restart due to catastrophic engine failure related to an alleged faulty valve within 2.7 L and 3.0 L EcoBoost Engines.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	EWR D&I	Other	Total	EWR Field Reports
All Incidents:	56	396	0	1,761	1,066 *	0
Crashes/Fires:	0	0	0	0	0	0
Injury Incidents:	0	0	0	0	0	0
Number of Injuries:	0	0	0	0	0	0
Fatality Incidents:	0	0	0	0	0	0
Number of Fatalities:	0	0	0	0	0	0

Description of Other:
Manufacturer Warranty Claims & Engine Exchanges

*Total eliminates duplicates received by the manufacturer

ACTION/SUMMARY INFORMATION

Action: This (EA) Engineering Analysis is closed with 24V635.

Summary:

On July 22, 2022, the Office of Defects Investigation (ODI) granted a Defect Petition (DP22001) and opened a Preliminary Evaluation (PE22007) to investigate allegations of loss of motive power in model year (MY) 2021 Ford Bronco vehicles equipped with 2.7L EcoBoost engines. Complainants were reporting sudden engine failure while driving resulting in a loss of motive power, often without the ability to restart. During PE22007, the cause of engine failure and loss of motive power in the subject vehicles was determined to be intake valve fracture, and the full scope of vehicles affected by the subject defect was identified as all MY 2021-2022 Ford and Lincoln models equipped with either the 2.7L or 3.0L EcoBoost engines, referred to as the “Nano” engine family. If an intake valve fractures in the subject engines, it may drop into the cylinder and contact the piston, often resulting in catastrophic engine damage.

On September 29, 2023, PE22007 was upgraded to an Engineering Analysis (EA23002) to further investigate the subject defect across the full scope of affected vehicles. During EA23002, ODI visited Ford facilities to review technical information related to intake valve fracture in “Nano” engines, coordinated with NHTSA’s Vehicle Research and Testing Center (VRTC), and analyzed updated field data relating the subject defect. Forensic analysis of fractured intake valves demonstrated that the defective components exhibited “grinding burn” or out of specification hardness in the area of the keeper grooves. The presence of grinding burn is evidence that during the groove grinding phase of production, the temperature of the valve became sufficiently high to alter the microstructure of the material and is indicative that the valve supplier’s manufacturing processes were not within control specifications. Grinding burn results in a hard, brittle microstructure and high residual stresses toward the surface of the valve. Through normal engine loading, a valve with grinding burn will likely fracture at the area of highest vulnerability, which is the third keeper groove.

In its response to the EA23002 Information Request (IR) letter, Ford provided evidence of 396 customer complaints (including field reports), 825 warranty claims, and 936 engine exchanges. When considering both ODI and manufacturer failure report data, there have been reports representing 1066 unique vehicles within the subject vehicle population. Analysis of the failure report data demonstrates that vehicles equipped with potentially defective intake valves were built within a production “spike period” of May 2021 – October 2021. The beginning of the spike period corresponds to a ramp up in production at the valve supplier manufacturing facility, and the end of the spike period aligns with the implementation of several mid-production process improvements and the decision to change the metal alloy used to produce intake valves from “Silchrome Lite” to “Silchrome 1”.

Ford began investigating the subject defect in July 2021, determined the root cause, and took corrective measures for the new production vehicles. Analysis of the failure report data demonstrates that these corrective actions were successful in eliminating the risk of intake valve fracture for subject vehicles produced after October 2021. However, Ford did not take any field action to address vehicles produced during the spike period, and in the several months following the implementation of the production changes, a significant number of field failures continued to occur.

It is Ford’s assessment that not all valves produced during the spike period are defective, and that failures associated with the subject defect occur at low time in service. Analysis of the failure report data demonstrates that the vast majority of failures have occurred before 20,000 miles

with over half of all reported failures occurring before 5,000 miles. The rate of reported failures related to the subject defect has steadily decreased since November 2021. ODI coordinated with NHTSA's National Center for Statistics and Analysis (NCSA) to conduct statistical analysis and predict the number of future failures associated with the subject defect. The results of this analysis, and the trends identified through the failure report data are generally consistent with Ford's assessment that defective intake valves will likely fail at a low time in service and indicate that the majority of subject vehicles equipped with defective valves have already experienced a failure.

On August 23, 2024, Ford submitted recall 24V635 for subject vehicles equipped with "Nano" engines and built within the production spike period identified above (total population 90,736 vehicles). The remedy includes an inspection at a Ford/Lincoln dealership where the lifetime engine cycles of the vehicle will be determined. If a vehicle does not meet a threshold for lifetime engine cycles, the dealership will conduct a high RPM engine cycle accumulation procedure, which aims to identify if the vehicle is equipped with defective intake valves. Any vehicle that fails the accumulation procedure will receive an engine replacement under the recall. In addition to recall 24V635, Ford has stated that it will launch customer satisfaction campaign 24N12, which will provide extended warranty coverage to the subject vehicles through the earlier of 10 years or 150,000 miles. In view of the recall action being taken by Ford, ODI is closing this Engineering Analysis. To review the reports cited in the Closing Resume ODI Report Identification Number document, go to NHTSA.gov.