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Office of Defects Investigation  
National Highway Traffic Safety Administration  
1200 New Jersey Avenue SE, W45-302  
Washington, DC 20590

Subject: PE22-007: NEF-0103

The Ford Motor Company (Ford) response to the Agency's letter (received August 8, 2022) concerning reports of allegations of loss of motive power in certain model year (MY) 2021 Ford Bronco vehicles equipped with the 2.7L EcoBoost engine is attached.

If you have any questions concerning this response, please feel free to contact me.

## FORD MOTOR COMPANY (FORD) RESPONSE TO PE22-007

Ford's response to this Preliminary Evaluation information request was prepared pursuant to a diligent search for the information requested. While we have employed our best efforts to provide responsive information, the breadth of the agency's request and the requirement that information be provided on an expedited basis make this a difficult task. We nevertheless have made substantial effort to provide thorough and accurate information, and we would be pleased to meet with agency personnel to discuss any aspect of this Preliminary Evaluation.

The scope of Ford's investigation conducted to locate responsive information focused on Ford employees most likely to be knowledgeable about the subject matter of this inquiry and on review of Ford files in which responsive information ordinarily would be expected to be found and to which Ford ordinarily would refer. Ford notes that although electronic information was included within the scope of its search, Ford has not attempted to retrieve from computer storage electronic files that were overwritten or deleted. As the agency is aware, such files generally are unavailable to the computer user even if they still exist and are retrievable through expert means. To the extent that the agency's definition of Ford includes suppliers, contractors, and affiliated enterprises for which Ford does not exercise day-to-day operational control, we note that information belonging to such entities ordinarily is not in Ford's possession, custody or control.

Ford has construed this request as pertaining to vehicles manufactured for sale in the United States, its protectorates, and territories.

Ford notes that some of the information being produced pursuant to this inquiry may contain personal information such as customer names, addresses, telephone numbers, and complete Vehicle Identification Numbers (VINs). Ford is producing such personal information in an unredacted form to facilitate the agency's investigation with the understanding that the agency will not make such personal information available to the public under FOIA Exemption 6, 5 U.S.C. 552(b)(6).

Answers to your specific questions are set forth below. As requested, after each numeric designation, we have set forth verbatim the request for information, followed by our response. Unless otherwise stated, Ford has undertaken to provide responsive information and documents dated up to and including August 8, 2022, the date of your inquiry. Ford has searched within the following offices for responsive documents: Sustainability, Environment and Safety Engineering, Ford Customer Service Division, Global Core Engineering, Office of the General Counsel and North American Product Development.

### Request 1

State, by model and model year, the number of the subject vehicles and peer vehicles Ford has manufactured for sale or lease in the United States. Separately, for each subject vehicle manufactured to date by Ford, state the following:

- a. Vehicle identification number (17-character VIN);
- b. Make;
- c. Model;
- d. Model Year;
- e. Date of manufacture (MM/DD/YYYY);

- f. Date warranty coverage commenced (MM/DD/YYYY); and
- g. The State in the United States where the vehicle was originally sold or leased or delivered for sale or lease (postal abbreviation).

Provide the table in Microsoft Access 2010 and Microsoft Excel, or a compatible format, entitled "PRODUCTION DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

### Answer

Ford records indicate that the number of 2021 model year Ford Bronco vehicles equipped with the 2.7L EcoBoost engine ("Subject vehicles") manufactured for sale or lease in the United States (the 50 states and the District of Columbia), protectorates, and federalized territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) is 25,619.

Ford records indicate that the number of 2022 model year Ford Bronco vehicles and all 2021 and 2022 model year Ford F-150, Ford Edge, Ford Edge ST and Lincoln Nautilus vehicles equipped with the 2.7L EcoBoost engine ("Peer vehicles") manufactured for sale or lease in the United States (the 50 states and the District of Columbia), protectorates, and federalized territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) is 204,210.

The number of subject and peer vehicles sold in the United States (the 50 states and the District of Columbia), protectorates, and federalized territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) by make, model and model year (MY) is shown below:

MAKE	MODEL	2021 MY	2022 MY
FORD	BRONCO	25619	33106
FORD	F-150	110564	45055
FORD	EDGE	0	0
FORD	EDGE ST	3313	3576
LINCOLN	NAUTILUS	4739	3857

The requested data is provided in Appendix A. Ford notes that 2021 and 2022 MY Ford Edge ST vehicles are equipped with the 2.7 EcoBoost engine. The 2.7 EcoBoost engine is not available on other 2021-2022 MY Ford Edge variants.

Ford has provided the data in Microsoft Excel and presumes that this meets the expectations of the agency. Ford will provide data in an alternate format upon request.

### Request 2

State the total number of each of the following, received by Ford, or of which Ford is otherwise aware, which relate to, or may relate to, the alleged defect in the subject vehicles and peer vehicles. Please provide your response in the format shown in Figure 1 on Page 5.

- a. Consumer complaints, including those from fleet operators;
- b. Field reports, including dealer field reports;

- c. Reports involving a crash, injury or fatality;
- d. Reports involving a fire;
- e. Property damage claims;
- f. Third-party arbitration proceedings, both pending and closed, where Ford is or was a party to the arbitration; and
- g. Lawsuits, both pending and closed, in which Ford is or was a defendant or codefendant.

For subparts "a" through "f, / g," state the total number of each item (e.g., consumer complaints, field reports, etc.) separately. Multiple incidents involving the same vehicle are to be counted separately. Multiple reports of the same incident are also to be counted separately (i.e., a consumer complaint and a field report involving the same incident in which a crash occurred are to be counted as a crash report, a field report and a consumer complaint).

For items "c" through "f, / g," provide a summary description of the alleged problem and causal and contributing factors and Ford assessment of the problem, with a summary of the significant underlying facts and evidence. For items "e/f" and "f, / g," identify the parties to the action, as well as the caption, court, docket number, and date on which the complaint or other document initiating the action was filed.

### Answer

For purposes of identifying reports of incidents that may be related to the alleged defect and any related documents, Ford has gathered "owner reports" and "field reports" maintained by Ford Customer Service Division (FCSD), and claim and lawsuit information maintained by Ford's Office of the General Counsel (OGC).

Descriptions of the FCSD owner and field report systems and the criteria used to search each of these are provided in Appendix B.

The following categorizations were used in the review of reports located in each of these searches:

<b>Category</b>	<b>Definition</b>
A	Allegation of loss of motive power (LOMP), which was caused by, or may have been caused by, any of the subject components; vehicle was in motion
B	Allegation of LOMP while vehicle was in motion in which the failed component is unknown or unclear
C1	Valve issue (known or potential), no LOMP alleged while vehicle in motion; with indication (e.g., noise, cluster message, check engine light, etc.)
C2	Valve issue (known or potential) resulting in LOMP while vehicle not in motion (e.g., in a driveway or at a stop sign)
C3	Valve issue (known or potential), no start
D	Valve Issue (known or potential), ambiguous circumstances

Per discussion on August 11, 2022, the agency provided a revision to the alleged defect contained in the Information Request provided by Office of Defects Investigation on August 8, 2022. The revised alleged defect is "any allegation of loss of motive power (LOMP), which

was caused by, or may have been caused by, any of the subject components (valvetrain components); or any alleged LOMP in which the failed component is unknown or unclear (i.e., Ford can exclude alleged LOMP for causes known to be something other than the subject component)." Ford has included categories "A" through "D" as responsive to the agency's request.

Owner Reports: Records identified in a search of the Global Contact Center Technology (GCCT) database, as described in Appendix B, were reviewed for relevance and sorted in accordance with the categories described above. The number and copies of relevant owner reports identified in this search for the alleged defect are provided in the GCCT portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

When we were able to identify that responsive (i.e., not ambiguous) duplicate owner reports for an alleged incident were received, each of these duplicate reports was marked accordingly, and the group counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one report associated with their VINs. These reports have been counted separately.

Field Reports: Records identified in a search of the Common Quality Indicator System (CQIS) database, as described in Appendix B, were reviewed for relevance and sorted in accordance with the categories described above. The number and copies of relevant field reports identified in this search for the alleged defect are provided in the CQIS portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

When we were able to identify that responsive duplicate field reports for an alleged incident were received, each of these duplicate reports was marked accordingly, and the group counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one report associated with their VINs. These reports have been counted separately.

VOQ Data: Of the twenty-six (26) VOQs provided by the agency in the Information Request, three were associated with defect petitions and it is not apparent that the petitioners have experienced the alleged defect. Of the remaining twenty-three (23) VOQs, seventeen (17) have provided full 17-digit Vehicle Identification Numbers (VINs). One of the seventeen (17) VINs has two associated VOQs. For the VOQs where the full VIN is not reported, Ford is unable to search its databases for corresponding reports.

Ford made inquiries of its GCCT database for customer contacts, its CQIS database for field reports, and its Global System for Analytics and Research (GSAR) database for warranty repairs for the sixteen (16) full VINs associated with the VOQs provided by the agency in the Information Request. Reports where identified are provided in the database contained in Appendix C.

Crash/Injury/Fatality Incident Claims: Ford identified no reports of accident, physical injury or fatality pertaining to the alleged defect in subject vehicles.

Claims, Lawsuits, and Arbitrations: For purposes of identifying incidents that may relate to the alleged defect in a subject or peer vehicle, Ford has gathered claim and lawsuit information maintained by Ford's OGC. Ford's OGC is responsible for handling various legal matters,

including product liability lawsuits, claims, and consumer breach of warranty lawsuits and arbitrations against the Company.

Lawsuits and claims gathered in this manner were reviewed for relevance and categorized in accordance with the categories described above.

We are providing the requested detailed information, where available, for the responsive and ambiguous lawsuits and claims in our Log of Lawsuits and Claims, provided in Appendix D (see files PE22-007 REQUEST NUMBER TWO DATA – SUBJECT and PE22-007 REQUEST NUMBER TWO DATA – PEER). The number of relevant lawsuits and claims identified is also provided in this log. To the extent available, copies of complaints or first notices relating to matters shown on the log are provided in Appendix D. To the extent available, GCCT reports related to the matter on the log are provided in Appendix C. With regard to these lawsuits and claims, Ford has not undertaken to contact outside law firms to obtain additional documentation.

Reports are summarized in Figure 1 in Appendix C. Categories A and B are included in the “Relate To” sections of Figure 1 for subject and peer vehicles as they indicate a loss of motive power while the vehicle is in motion, which is what Ford understands as the focus of the agency’s request. Reports for Categories C1, C2, C3 and D are summarized in the “May Relate To” sections for subject and peer vehicles.

### Request 3

Separately, for each item (complaint, report, claim, notice, or matter) within the scope of your response to Request No. 2, state the following information:

- a. Ford’s file number or another identifier used;
- b. The category of the item, as identified in Request No. 2 (i.e., consumer complaint, field report, etc.);
- c. Vehicle owner or fleet name (and fleet contact person), email address and telephone number (please use distinct fields for each data type);
- d. Vehicle owner or fleet street address, city, state (postal abbreviation), and ZIP code (please use distinct fields for each data type);
- e. Vehicle’s 17-character VIN;
- f. Vehicle’s make, model and model year (please use distinct fields for each data type);
- g. Vehicle’s mileage at time of incident;
- h. Incident date (MM/DD/YYYY);
- i. Report or claim date (MM/DD/YYYY);
- j. Whether a crash is alleged;
- k. Whether property damage is alleged;
- l. Number of alleged injuries, if any; and
- m. Number of alleged fatalities, if any.

Provide this information in Microsoft Access 2010 and Microsoft Excel, or a compatible format, entitled “REQUEST NUMBER TWO DATA.” A pre-formatted data collection file, which provides further details regarding this submission, will be provided to you.

### Answer

Ford is providing owner and field reports in the database contained in Appendix C in response to Request 2. To the extent information sought in Request 3 is available for owner and field reports, it is provided in the database. To the extent information sought in Request 3 is available for lawsuits and claims, it is provided in the Log of Lawsuits and Claims provided in Appendix D.

#### Request 4

Produce copies of all documents related to each item within the scope of Request No. 2. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method Ford used for organizing the documents. Describe in detail the search methods and search criteria used by Ford to identify the items in response to Request No. 2.

#### Answer

Ford is providing owner and field reports in the database contained in Appendix C in response to Request 2. To the extent information sought in Request 4 is available for lawsuits and claims, it is provided in Appendix D.

Detailed descriptions of the search methods and criteria, including all pertinent parameters, used to identify the items provided in response to Request 3 are described in Appendix B.

#### Request 5

State, by model and model year, a total counts for all of the following categories of claims, collectively, that have been paid by Ford to date that relate to, or may relate to, the alleged defect in the subject vehicles and peer vehicles: warranty claims; extended warranty claims; claims for good will services that were provided; field, zone, or similar adjustments and reimbursements; and warranty claims or repairs made in accordance with a procedure specified in a technical service bulletin or customer satisfaction campaign. Please provide the counts as shown in Figure 1 on Page 5 (see the column "Request 5").

Separately, for each such claim, state the following information:

- a. Ford's claim number;
- b. Vehicle owner or fleet name (and fleet contact person), email address and telephone number (please use distinct fields for each data type);
- c. Vehicle owner or fleet street address, city, state (postal abbreviation), and ZIP code (please use distinct fields for each data type);
- d. 17-character VIN;
- e. Repair date (MM/DD/YYYY);
- f. Vehicle mileage at time of repair;
- g. Repairing dealer's or facility's name, telephone number, city and state or ZIP code (please use distinct fields for each data type);
- h. Labor operation number(s);
- i. Problem code(s);
- j. Diagnostic trouble code(s);
- k. Replacement part number(s) and description(s);
- l. Concern stated by customer;
- m. Cause as stated on the repair order;

- n. Correction as stated on the repair order; and
- o. Additional comments, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2010 and Microsoft Excel format when possible, or a compatible format, entitled "WARRANTY DATA." A pre-formatted data collection file, which provides further details regarding this submission, will be provided to you.

#### Answer

Records identified in a search of the GSAR and Concern Driven Reporting (CDR) databases, as described in Appendix B, were reviewed for relevance and sorted in accordance with the categories described in the response to Request 2. The number and copies of relevant warranty claims identified in this search that may relate to the alleged defect in a subject vehicle are provided in the GSAR portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

When Ford was able to identify that duplicate claims for an alleged incident were received, each of these duplicate claims was marked accordingly and the group counted as one report. In other cases, certain vehicles may have experienced more than one incident and have more than one claim associated with their VINs. These claims have been counted separately.

Requests for "goodwill, field, or zone adjustments" received by Ford to date that relate to the alleged defect that were not honored, if any, would be included in the GCCT reports identified above in response to Request 2. Such claims that were honored are included in the warranty data provided. Ford assumes that providing the warranty claims in the electronic database format meets the requirements of this request as the agency can review or order the claims as desired.

Reports are summarized in Figure 1 in Appendix C. Categories A and B are included in the "Relate To" sections of Figure 1 for subject and peer vehicles as they indicate a loss of motive power while the vehicle is in motion, which is what Ford understands as the focus of the agency's request. Reports for Categories C1, C2, C3 and D are summarized in the "May Relate To" sections for subject and peer vehicles.

#### Request 6

Describe in detail the search methods and search criteria used by Ford to identify the claims in response to Request No. 5, including the labor operations, problem codes, diagnostic trouble codes, part numbers and any other pertinent parameters used.

#### Answer

A detailed description of the search criteria, including all pertinent parameters, used to identify the claims provided in response to Request 5 are described in Appendix B.

#### Request 7

Provide a list of all labor operations, labor operation descriptions, problem codes, and problem code descriptions, diagnostic trouble codes and diagnostic trouble code descriptions applicable to the alleged defect in the subject vehicles. State whether the diagnostic trouble

codes are automatically reported to the warranty database electronically or manually entered into the warranty database by a claims administrator.

#### Answer

Information applicable to specific claims as requested above can be found in Appendix C. Diagnostic trouble codes are manually entered into the warranty database by the claim administrator.

#### Request 8

State, by make and model year, the terms of the new vehicle warranty coverage offered by Ford on the subject vehicles (i.e., the number of months and mileage for which coverage is provided and the vehicle systems that are covered). Describe any extended warranty coverage option(s) that Ford offered for the subject vehicles and state by option, model, and model year, the number of vehicles that are covered under each such extended warranty.

#### Answer

For 2021 model year Ford Bronco vehicles, the New Vehicle Limited Warranty, Bumper-to-Bumper Coverage begins at the warranty start date and lasts for three years or 36,000 miles, whichever occurs first. The New Vehicle Limited Warranty, Powertrain Coverage begins at the warranty start date and lasts for five years or 60,000 miles, whichever occurs first.

Optional Extended Service Plans (ESPs) are available to cover various vehicle systems, time in service, and mileage increments. As of the date of the information request, 5,704 new and used vehicle ESP policies had been purchased for 2021 model year Ford Bronco vehicles that could potentially cover the alleged defect in the subject vehicles. Ford is unable to determine how many of the ESP policies are applicable to the subject vehicles. The details of the various plans are provided in Appendix I.

#### Request 9

Produce copies of all service, warranty, and other documents that relate to, or may relate to, the alleged defect in the subject vehicles, that Ford has issued to any dealers, regional or zone offices, field offices, fleet purchasers, or other entities. This includes, but is not limited to, bulletins, advisories, informational documents, training documents, or other documents or communications, with the exception of standard shop manuals. Also include the latest draft copy of any communication that Ford is planning to issue within the next 120 days.

#### Answer

For purposes of identifying communications to dealers, zone offices, or field offices pertaining, at least in part, to the alleged defect, Ford has reviewed the following FCSD databases and files: The On-Line Automotive Service Information System (OASIS) containing Technical Service Bulletins (TSBs), Special Service Messages (SSMs) and Internal Service Messages (ISMs); ISMs contained in CQIS; and Field Review Committee (FRC) files. We assume this request does not seek information related to electronic communications between Ford and its dealers regarding the order, delivery, or payment for replacement parts, so we have not included these kinds of information in our answer.

A description of Ford's OASIS messages, ISMs, and the Field Review Committee files and the search criteria used are provided in Appendix B.

OASIS Messages: Ford has not identified any TSB or SSM communications that may relate to the agency's request.

Internal Service Messages: Ford has not identified any ISM communications that may relate to the agency's request.

Field Review Committee: Ford has not identified any field service action communications that may relate to the agency's request.

Ford currently has no plans to issue communications related to the alleged defect that is the subject of NHTSA's investigation.

### Request 10

Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that relate to, or may relate to, the alleged defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, Ford. For each such action, provide the following information:

- a. Action title or identifier;
- b. The actual or planned start date;
- c. The actual or expected end date;
- d. Brief summary of the subject and objective of the action;
- e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action;
- f. Brief summary of the findings and/or conclusions resulting from the action; and
- g. For each failed engine examined by Ford, provide a description, photos/videos of which cylinder failed, intake or exhaust valves, spark plugs or borescope images. Provide a diagnosis or determination of the failed component and root cause.

For each action identified, provide copies of all documents related to the action, regardless of whether the documents are in interim, draft, or final form. Organize the documents chronologically by action.

### Answer

Ford is construing this request broadly and is providing not only studies, surveys, and investigations related to the alleged defect, but also notes, correspondence, and other communications that were located pursuant to a diligent search for the requested information. Ford is providing the responsive non-confidential documentation in Appendix E.

To the extent that the information requested is available, it is included in the documents provided. If the agency should have questions concerning any of the documents, please advise.

Ford is submitting additional responsive documentation in Appendix F with a request for confidentiality in a separate file transfer to the agency's Office of the Chief Counsel pursuant

to 49 CFR Part 512. Redacted copies of the confidential documents are also provided in Appendix E1 and are labeled "Public."

In the interest of ensuring a timely and meaningful submission, Ford is not producing materials or items containing little or no substantive information. Examples of the types of materials not being produced are meeting notices, raw data lists (such as part numbers or VINs) without any analytical content, duplicate copies, non-responsive elements of responsive materials, and draft electronic files for which later versions of the materials are being submitted.

Ford is not producing documents responsive to this request that are protected from disclosure by attorney-client privilege, work-product doctrine, or other applicable immunity. Documents protected from disclosure on these bases are described in a privilege log contained in Appendix K.

In response to Request 10, subpart "g," Ford is providing the engine analysis log maintained by Engine Engineering in Appendix G, in addition to images and videos contained in Appendices E and F.

Through this method, Ford is seeking to provide the agency with substantive responsive materials in our possession in the timing set forth for our response. We believe our response meets this goal. If the agency would like additional materials, please advise.

#### Request 11

Describe all modifications or changes made by, or on behalf of, Ford in the design, material composition, manufacture, quality control, supply, or installation of the subject component, from the start of production to date, which relate to, or may relate to, the alleged defect in the subject vehicles. For each such modification or change, provide the following information:

- a. The date or approximate date on which the modification or change was incorporated into vehicle production;
- b. A detailed description of the modification or change;
- c. The reason(s) for the modification or change;
- d. The part number(s) (service and engineering) of the original component;
- e. The part number(s) (service and engineering) of the modified component;
- f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
- g. When the modified component was made available as a service component; and
- h. Whether the modified component can be interchanged with earlier production components.

Also, provide the above information for any modification or change that Ford is aware of which may be incorporated into vehicle production within the next 120 days.

#### Answer

Ford understands this request to relate to the subject components which relate to, or may relate to, the alleged defect in the subject vehicles. This information can be found in Appendix H.

The Nano intake valve material was changed from “Silchrome 1” to “Silchrome Lite” in May, 2018. The Silchrome Lite material is an industry-recognized valve material with widespread usage in engine valves and is included in the Society of Automotive Engineers (SAE) Engine Poppet Valve Information Report J775\_201801 material specification UNS K14072 (reference *SAE International Surface Vehicle Information Report, “Engine Poppet Valve Information Report,” SAE Standard J775, Rev. Jan. 2018*).

The design change to the Silchrome Lite material followed all Ford design and validation disciplines, including three Ford Engine Fatigue Tests which were completed as part of the material change validation process. The Engine Fatigue Test is designed to evaluate the engine’s robustness to structural fatigue caused by repetitive mechanical loading at high engine speeds and high cylinder pressures. This test cycle is designed to achieve at least 35 million full load cycles on the engine and includes engine speeds ranging from idle to the maximum design speed of the engine. A detailed post-analysis of the subject valves was completed, indicating passing results.

### Request 12

State the number of each of the following that Ford has sold that may be used in the subject vehicles by component name, part number (both service and engineering/production), model and model year of the vehicle in which it is used and month/year of sale (including the cutoff date for sales, if applicable):

- a. Subject component; and
- b. Any kits that have been released, or developed, by Ford for use in service repairs to the subject component/assembly.

For each component part number, provide the supplier’s name, address, and appropriate point of contact (name, title, and telephone number). Also, identify by make, model and model year, any other vehicles of which Ford is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

### Answer

As the agency is aware, Ford service parts are sold in the U.S. to authorized Ford and Lincoln dealers. Ford has no means to determine how many of the parts were actually installed on vehicles, the vehicle model or model year on which a particular part was installed, the reason for any given installation, or the purchaser’s intended use of the components sold.

Ford is providing the total number of Ford service replacement subject component parts by part number (both service and engineering), year of sale, where available, and supplier point of contact information in Appendix J.

Ford notes that the subject component parts are used on other Ford vehicle lines and applications.

### Request 13

Furnish Ford’s assessment of the alleged defect in the subject vehicle, 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 report included with this inquiry, including the counts as shown in Figure 1 on Page 5 (see the column "Request 13").

### Answer

NHTSA's Office of Defects Investigation (ODI) opened this Preliminary Evaluation based on "... Vehicle Owner Questionnaire (VOQ) reports of loss of motive power at highway speeds with no-restart due to catastrophic engine failures in certain MY Ford Bronco vehicles equipped with the 2.7L Eco-boost (sic) engines." Ford has conducted an investigation associated with this subject, including the cause of these reports, the circumstances under which they occur, and the anticipated performance of these products moving forward.

The 2.7L EcoBoost (Nano) V6 engine was first introduced on the 2015 MY Ford F-150 and is equipped on several Ford products including the Bronco. As part of normal monitoring of field data, Ford had previously initiated an investigation into reports of engine failure on these vehicles. To date, over 360 engines associated with these reports have been returned from the field and inspected. Engineering evaluation of those engines found intake valve fracture as the cause. Further investigation of the fractured valves from these engines has found evidence of grinding burn and over-specification hardness, indicating the valve supplier's keeper groove grinding and heat treat processes were not within control specifications. After fracture, the valve may contact the piston and may be pushed back into the cylinder head. Associated symptoms can range from reduced engine performance to engine stall depending on the final position of the fractured valve. Engine damage depends on speed and engine load when the valve fracture occurs and how long the vehicle is driven after fracture. Repair of damage caused by an intake valve fracture on these engines typically involves a full engine replacement.

Ford expects that valve fractures associated with this subject would occur at low time in service and not all valves were produced with grinding burn or out of specification hardness. Grinding burn is a result of high workpiece temperatures during grinding and produces a hard, brittle microstructure and high residual stresses toward the surface of the valve. When a valve keeper groove containing this microstructure is subjected to the application loading from normal engine operating conditions, a micro-crack initiates at low time in service at the surface and propagates in fatigue until the cross section of the valve is unable to support normal application loading and the valve fractures.

The current overall rate of reports relating to fractured valve stems in the subject vehicles is low at 0.8 R/1000. Of those, nearly half describe symptoms other than loss of mobility while the vehicle is in motion. Several customers report that after experiencing a valve stem fracture, they are able to continue driving until they find a location to stop and request service (as stated in warranty claims). Those customers often report a message to pull over and restart the vehicle, reduced power, a check engine light, vibration and/or noise. A higher number of customers report engine failure while the vehicle is not in motion (i.e., at start-up or at a stop light/stop sign). Though engine stall due to valve stem fracture can occur while the

vehicle is in motion, the vehicle will coast to a stop (the powertrain will not “lock”). As of the time of this response, Ford is not aware of any accidents, fires, injuries or property damage attributed to valve stem fracture on subject or peer vehicles. In addition to other warning lights, white smoke has been reported in certain circumstances and is due to the combustion process and entrance of coolant into the exhaust system.

Statistical models show that the majority of issues relating to valve stem fracture in these vehicles have already occurred. Ford used a variety of statistical analyses models to evaluate the performance of these engines in the field, including Weibull analyses. These statistical models of actual field data support that this is a low time in service condition (limited failure population), which is consistent with Ford’s understanding of the cause of valve stem fracture in these engines.

Ford acknowledges that intake valve fracture has been a dissatisfier for our customers, with significant inconvenience for those who experience resultant engine failure on a new Ford Bronco. However, Ford believes that this does not present an unreasonable safety risk in the field. Engineering analysis and statistical review finds that most vehicles are not susceptible to this condition, and that issues should they exist would be expected to occur at low time in service. Valve stem fracture in these vehicles can result in a variety of symptoms other than engine stall while the vehicle is in motion, including engine no-start, warning lights without engine stall, or engine stall while the vehicle is not in motion. Ford will continue to actively monitor this subject through our internal investigation process and will keep the agency informed of our findings.

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