



Steve M. Kenner, Global Director
Automotive Safety Office
Sustainability, Environment & Safety Engineering

Fairlane Plaza South, Suite 400
330 Town Center Drive
Dearborn, MI 48126-2738

March 19 2015

Mr. Frank S. Borris, Director
Office of Defects Investigation
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE, Room W45-302
Washington, DC 20590

Dear Mr. Borris:

Subject: RQ14-005: NVS-214kmb

The Ford Motor Company (Ford) response to the Agency's February 5, 2015 letter concerning reports of alleged allegations of loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction mode and a vehicle commanded engine shutdown with no immediate restart capability in certain model year (MY) 2011-2014 Ford F-250, F-350, F-450, and F-550 "Super Duty" vehicles equipped with 6.7L diesel "Power Stroke" engines manufactured by Ford Motor Company (Ford) is attached.

During Ford's original investigation that resulted in safety recall 13S10, the evaluation of field return parts identified open and short circuit faults for the EGT sensors. No other EGT sensor fault modes were identified at that time. As part of this investigation, Ford conducted a comprehensive study that included evaluating engine calibration operation after manually inserting EGT faults in every combination and condition (i.e., open, short, and out of range) for all four sensor positions, extensive drive evaluations of vehicles while manually inserting faults, thorough evaluation of service data retrieved during warranty repair diagnostics, and a review of the reports identified for this response. Ford's most recent analysis of parts with higher time in service failures, identified additional EGT sensor fault modes not previously identified. In addition to the new sensor fault modes, the investigation and testing identified that certain fault modes in sensor locations other than the one identified in 13S10 could also lead to a Stop Safely Now (SSN) mode.

As a result, on March 16, 2015, Ford's Field Review Committee approved safety recall 15S09 to address unique concerns for patient safety in ambulance and fire engine package vehicles. Although field data indicates a significant reduction in non-over temperature SSN events for the 2013 and later model years, out of an abundance of caution and desire to have a consistent level of engine calibration across the model years, Ford is including all 6.7L vehicles equipped with ambulance and fire engine packages built

from February 22, 2010, through January 30, 2015, when the latest EGT sensor hardware was implemented in production, in safety recall 15S09.

Ford does not believe that this SSN mode presents an unreasonable risk to safety in non-ambulance vehicles due to overt audible and visual warning and the gradual reduction in engine torque that provides the ability to control and maneuver the vehicle to a safe location. This position is further supported by no accident or injury reports that are attributable to this condition. In addition Ford believes that the incremental actions we have voluntarily taken appropriately address any unique concerns for patient safety associated with this condition in ambulance and fire engine package vehicles.

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

Sincerely,



for

Steven M. Kenner

Attachment

FORD MOTOR COMPANY (FORD) RESPONSE TO RQ14-005
(NVS-214kmb)

Ford's response to this Recall Query 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 Recall Query.

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 documents dated up to and including February 5, 2015, the date of your inquiry. Ford has searched within the following offices for responsive documents: Sustainability, Environment and Safety Engineering, Ford Customer Service Division, Office of the General Counsel, Vehicle Operations, North American Product Development, and Ford of Europe Product Development.

Request 1

State, by model and model year, the number of subject 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 (VIN);
- b. Make;
- c. Model;

- d. Model Year;
- e. Subject component part number and design version installed as original equipment;
- f. Powertrain control module calibration software version installed as original equipment;
- g. Whether it is within the scope of the subject recall;
- h. Whether the subject recall repairs have been performed;
- i. Date of manufacture;
- j. Date warranty coverage commenced; and
- k. The State in the United States where the vehicle was originally sold or leased (or delivered for sale or lease).

Provide the table in Microsoft Access 2010, or a compatible format, entitled "PRODUCTION DATA." A pre-formatted data collection file, which provides further details regarding this submission, will be provided to you.

Answer

Ford records indicate that the approximate total number of subject vehicles sold in the United States, (the 50 states and the District of Columbia) protectorates, and territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and Virgin Islands) is 508,070.

The number of subject vehicles sold in the United States by model and model year is shown below.

Model	2011 MY	2012 MY	2013 MY	2014 MY
Ambulance/Fire	1,225	1,648	1,143	830
Total	155,363	161,174	96,534	94,999

The requested data for each subject vehicle is provided in Appendix A, except for the Powertrain control module calibration software version. The Powertrain control module calibration software version installed as original equipment is provided in Appendix A1.

Request 2

State the 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:

- a. Consumer complaints, including those from fleet operators;
- b. Field reports, including dealer field reports;
- c. Reports involving a crash, injury or fatality;
- d. Property damage claims;
- e. Third-party arbitration proceedings where Ford is or was a party to the arbitration; and
- f. Lawsuits, both pending and closed, in which Ford is or was a defendant or codefendant.

For subparts "a" through "f," 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).

In addition, for items "c" through "f," provide a summary description of the alleged problem and causal and contributing factors and Ford's assessment of the problem, with a summary of the significant underlying facts and evidence. For items "e" and "f," 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.

Although the alleged defect in the information request is "loss of sensing function of one or more EGT sensors" the Agency's letter indicates that the inquiry is to investigate "allegations of loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart capability.

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

Category	Allegation
A	Stop Safely Now (Power reduction-Shut Down - No Restart) – (EGT)
B	Light on EGT replaced or EGT replaced with no indication of Power Reduction and Engine Shut Down
D	Recall 13S10

We are providing electronic copies of reports categorized as "B" as "non-specific allegations" for your review because of the broad scope of the request. Based on our engineering judgment, the information in these reports is insufficient to support a determination that they pertain to a of loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart capability.

Owner Reports: Records identified in a search of the FMC360 Owner Relations System, 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 that allege a loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart capability in a subject vehicle are provided in the FMC360 portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

Legal Contacts: Ford is providing, in Appendix B, a description of Legal Contacts and the activity that is responsible for this information. To the extent that responsive (i.e., not

ambiguous) owner reports indicate that they are Legal Contacts, Ford has gathered the related files from the Office of General Counsel (OGC). Non-privileged documents for files that were located that are related to the responsive owner reports are provided in Appendix D.

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 that allege a loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart capability in a subject vehicle are provided in the CQIS portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

VOQ Data: This information request had an attachment that included 31 Vehicle Owner Questionnaires (VOQs), 22 of which were duplicative of Ford reports. Ford made inquiries of its AWS database for claims, its FMC360 database for customer contacts, and its CQIS database for field reports regarding the vehicles identified on the VOQs.

Crash/Injury Incident Claims:

For purposes of identifying allegations of accidents or injuries that may have resulted from the alleged defect, Ford has reviewed responsive owner and field reports, and lawsuits and claims. Copies of reports corresponding to these alleged incidents are provided in the FMC360, CQIS, and Analytical Warranty System (AWS) portions of the database provided in Appendix C. Ford did not identify any accidents related to this condition. Ford identified one report of a vehicle (VIN 1FT7W2BT8BE[REDACTED]) that alleged contacting a curb and receiving some type of damage to the cargo bed from the 5th wheel trailer it was towing. The history of the vehicle identified two repairs to the vehicle, approximately four days apart, in two different states. The owner's description of the alleged incident is inconsistent with a Stop Safely Now event, and, based on the information provided, it is unclear when the alleged curb contact occurred or which service repair may have been related to the incident.

Claims, Lawsuits, and Arbitrations: For purposes of identifying incidents that may relate to the alleged defect in a subject vehicle, Ford has gathered claim and lawsuit information maintained by Ford's OGC. Ford's OGC is responsible for handling 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 sorted in accordance with the categories described above. Ford has also located other lawsuits, claims, or consumer breach of warranty lawsuits, each of which is ambiguous as to whether it meets the alleged defect criteria. We have included these lawsuits and claims as "non-specific allegations" for your review because of the broad scope of the request. Based on our engineering judgment, the information in these lawsuits and claims is insufficient to support a determination that they pertain to the alleged defect.

We are providing the requested detailed information, where available, on the responsive and ambiguous lawsuits and in Appendix C in the Legal Claim/Lawsuits tab. To the extent available, copies of complaints, first notices, or FMC360 reports relating to matters shown in Appendix C are provided in Appendix D.

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 other 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), street address, email address and telephone number;
- d. Vehicle's VIN;
- e. Vehicle's make, model and model year;
- f. Vehicle's mileage at time of incident;
- g. Incident date;
- h. Report or claim date;
- i. Whether a crash is alleged;
- j. Whether property damage is alleged;
- k. Number of alleged injuries, if any; and
- l. Number of alleged fatalities, if any.

Provide this information in Microsoft Access 2010, 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 Appendix C in the Legal Claim/Lawsuits tab.

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. Copies of complaints, first notices, or FMC360 reports relating to matters provided in Appendix C in the Legal Claim/Lawsuits tab are provided in Appendix D

Request 5

State, by model and model year, a total count 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: 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 or the subject recall.

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

- a. Ford's claim number;
- b. Vehicle owner or fleet name (and fleet contact person), street address, email address and telephone number;
- c. VIN;
- d. Repair date;
- e. Vehicle mileage at time of repair;
- f. Repairing dealer's or facility's name, telephone number, city and state or ZIP code;
- g. Labor operation number(s);
- h. Problem code(s);
- i. Diagnostic trouble code(s);
- j. Replacement part number(s) and description(s);
- k. Concern stated by customer;
- l. Cause as stated on the repair order;
- m. Correction as stated on the repair order; and
- n. Additional comments, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2010, 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 AWS database, 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 allege a loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart in a subject vehicle are provided in the AWS portion of the database contained in Appendix C. The categorization of each report is identified in the "Category" field.

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 FMC360 reports identified above in response to Request 2. Such claims that were honored are included in the warranty data provided.

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.

Provide a list of all labor operations, labor operation descriptions, problem codes, 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.

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. Describe the specific warranty provisions offered by Ford that cover the subject components. Describe the warranty coverage offered by Ford that covers the subject recall repairs.

Answer

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

Ford is providing in Appendix E a listing of all Customer Concern Codes and descriptions, a list of all condition codes and descriptions, and a listing of non TSB warranty labor operations codes and descriptions for diagnosing and replacing an EGT sensor. The diagnostic trouble codes and diagnostic trouble code descriptions which are included represent those which could lead to a loss of sensing function of one or more exhaust gas temperature (EGT) sensors resulting in power reduction (limp) mode and a vehicle commanded engine shutdown (engine stall) with no immediate restart on the subject vehicles.

All Diagnostic Trouble Codes retrieved during the initial diagnosis of a repair are recorded (or a diagnostic equipment printout is attached) on the hard copy and manually recorded in the DTC field in the Warranty Claiming System.

For 2011-2014 model years F-250, F-350, F-450, F-550 vehicles with the 6.7L diesel engine, 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 Emission Warranty Coverage begins at the warranty start date and lasts for five years or 50,000 miles, whichever occurs first. Optional Extended Service Plans (ESPs) are available to cover various vehicle systems, time in service, and mileage increments. The details of the various plans are provided in Appendix F. As of the date of the information request, 88,205 new vehicle ESP policies had been purchased on 2011-2014 model years F-250, F-350, F-450, F-550 vehicles with the 6.7L diesel engine.

Request 7

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 Agency's request, Ford has reviewed the following FCSD databases and files: The On-Line Automotive Service Information System (OASIS) containing Technical Service Bulletins (TSBs) and Special Service Messages (SSMs); Internal Service Messages (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 identified five SSMs and eight TSBs that may relate to the Agency's request and is providing copies of them in Appendix G.

Internal Service Messages: Ford has not identified any ISMs that relate to the Agency's request.

Field Review Committee: Ford has identified two field service action communications that may relate to the Agency's request and is providing copies of them in Appendix G.

Request 8

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, including all such actions related to the subject recall. 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; and
- f. A brief summary of the findings and/or conclusions resulting from the action.

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 advised the Agency in phone conversations on Tuesday, March 17, 2015 that the data in Appendix H and I may not be complete at the time of submission. Ford is working with our OGC and engineering to ensure we have the documents that meet the intent of the requested information. To the extent that the information requested is available, it is included in the documents provided. Ford will be sending updated Appendix H and I as soon as we have all of the information gathered and reviewed. If the Agency should have questions concerning any of the documents, please advise.

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 Ford documentation in Appendix H.

Ford is submitting additional responsive documentation in Appendix I with a request for confidentiality under separate cover to the Agency's Office of the Chief Counsel pursuant to 49 CFR Part 512. Redacted copies of the confidential documents will be provided under separate cover, on separate media, to the agency's Office of Chief Counsel as Appendix I – Redacted.

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 J.

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. 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 9

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 and the powertrain control module calibration software, 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 or software;
- e. The part number(s) (service and engineering) of the modified component or software;
- f. Whether the original unmodified component or software was withdrawn from production and/or sale, and if so, when;
- g. When the modified component or software was made available as a service component or software; and
- h. Whether the modified component or software can be interchanged with earlier production components or software.

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

A table describing the PCM software and EGT hardware changes is provided in Appendix K.

Request 10

Produce one of each of the following:

- a. Exemplar samples of each design version of the subject component;
- b. Field return samples of the subject component exhibiting the subject failure mode; and
- c. Any kits that have been released, or developed, by Ford for use in service repairs to the subject component/assembly which relate, or may relate, to the alleged defect in the subject vehicles.

Answer

Ford has included both failed EGT sensors as well as new production EGT sensors with this response. A log of those sensors is included in Appendix L.

Request 11

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 cut-off 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 EGT sensors by service part number and year/month of sale, where available, in Appendix M. Information pertaining to supplier information is also included in Appendix M.

The 2015 MY Transit 3.2L Diesel uses the same Stoneridge EGT Sensor, AC3A-12B591-AD/AC3Z-5J213-B sensor, which were used in Positions 11-12 on the subject vehicles built prior to 1/30/15.

Request 12

Provide the following information related to each item (subject component, powertrain control module calibration software version) within the scope of Request No.9:

- a. List and briefly describe all software diagnostic routines and associated diagnostic trouble codes performed on the subject component including, but not limited to, failure determination strategies such as calibration tests, continuity and accuracy checks, circuit high/low voltage and counter/timer thresholds;
- b. List and briefly describe EGT determination algorithms, including any designed-in system fail-soft strategies and countermeasures; and
- c. Specifications including functional and performance requirements, design constraints and validation plans.

Answer

Ford has included a copy of the Onboard Diagnostics (OBD) theory of operation in Appendix N. In addition we have included a copy of the Powertrain Control /Emission Diagnostic (PC/ED) manual, wiring diagram, and shop manual for the 2011-2014 6.7L Diesel, in a separate labeled CD.

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 role of the powertrain control module calibration software version installed;
- e. The stalling incident rates by model and model year estimated by Ford at 36- and 60-months in service based on statistical modeling of incident experience to date. Include a detailed explanation of Ford's method for performing the statistical analysis, the statistical model, files listing the failure and suspension inputs values, the model output parameters (e.g., Weibull slope and shape parameters), and the requested incident rate estimates;
- f. The risk to motor vehicle safety that it poses;
- g. 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. Include Ford's assessment of the time between the onset of the alleged defect condition and the powertrain control module command to shut down the engine, shown as a function of vehicle speed at onset of the alleged defect condition, road grade and curb weight; and
- h. The reports included with this inquiry.

AnswerBackground

The Ford 6.7L diesel engine utilizes four exhaust gas temperature (EGT) sensors in the exhaust system for emissions purposes and to monitor for potential over temperature conditions by providing signals to the powertrain control module (PCM). If an over temperature condition is

identified, the PCM will initiate a Failure Mode Effects Management (FMEM) that includes an overt warning to the operator that an issue has been identified so that the operator can take action while the system reduces engine power and, after the vehicle has effectively come to a stop, shuts the engine down. This FMEM system is designed to alert the operator to the condition while maintaining sufficient engine torque to allow them to maneuver the vehicle to a safe location. After shut down the PCM will prevent the engine from being restarted for a "cool down" period of between 10 and 60 minutes, depending on environmental conditions.

This FMEM system overtly alerts the operator with an audible chime that sounds five times while a "Stop Safely Now" message is displayed in the instrument cluster. The "wrench light" in the instrument cluster is also illuminated. After six seconds engine torque is gradually reduced by 70 percent over a period of 45 seconds after which sufficient torque to continue driving the vehicle is maintained. During this time the vehicle remains fully controllable and there is no effect on steering, braking, lighting, or other electrical system, or any restraint system. Independent of time, after the vehicle speed is reduced to less than approximately one mph, the system shuts the engine down and begins a cool down period.

As the Agency is aware, in October 2013 Ford Motor Company conducted a safety recall (NHTSA Recall No. 13V-535, Ford Recall No. 13S10) on certain model year (MY) 2011-2012 Ford F-350 SD, F-450 SD and F-550 SD "Ambulance Package" vehicles equipped with 6.7L diesel "Power Stroke" engines. This recall addressed a potential for the vehicle to enter a "Stop Safely Now" mode due to a single out of range EGT sensor fault code. At that time, Ford's internal testing, engineering evaluation, and analysis of warranty data and field reports indicated that only open or short circuit faults in the EGT sensor located directly downstream of the diesel particulate filter (DPF) in the exhaust system could cause a SSN condition. No other EGT sensor faults were observed in the analysis of field returned parts. Based on Ford's investigation, Ford determined that ambulance vehicles that could potentially be shut down for a cool down period between 10 to 60 minutes could potentially delay care or limit life support equipment operation, which could present a unique risk to patient safety. Due to their purpose and usage, these circumstances were considered unique to ambulance vehicles. The recall remedy replaced the EGT sensor located directly behind the DPF with a new more robust sensor. Due to the advanced warning, gradual reduction in engine torque and ability to maintain sufficient vehicle mobility to maneuver a vehicle to a safe location provided by this FMEM drive mode, Ford believed that this condition did not present an unreasonable risk to safety in non-ambulance vehicle packages.

Robustness Actions

In August 2014 Ford approved an emission recall (Ford 14E03) for 2011 through certain 2014 model year 6.7L engines to address a deficiency in the calibration related to the Diesel Exhaust Fluid (DEF) requirements. The U.S. Environmental Protection Agency (EPA) requires implementation of limitations, to prevent an increase in emission levels, on diesel engine systems when the vehicle has insufficient DEF levels. After providing advanced warning to the operator, those limitations include limiting engine speed to idle speed on subsequent engine restarts until the depleted DEF condition is corrected. It was determined that the original 6.7L engine calibration did not sufficiently limit vehicle operation or speed at depleted levels of DEF as required by EPA regulations. Specifically, under certain low DEF conditions, Ford certified with the EPA that the vehicle speed would be limited to a maximum of five mph until the DEF level was replenished. At depleted DEF levels, the original engine calibration inadvertently limited the vehicle speed to a higher vehicle speed. The calibration provided with the proactive 14E03 emissions recall corrected this condition and now more aggressively limits vehicle

operation at low DEF levels. As of the date of this submission, approximately 32% of the affected vehicles have had this recall completed.

Engine calibrations necessarily are continuously improved for robustness over time. When Ford introduces a revised service calibration, such as the calibration used for 14E03, it begins with the latest appropriate production calibration level. Since its first introduction in the 2011 model year, the 6.7L engine calibrations have received multiple driveability improvements, including certain robustness actions that reduced the number of SSN events from non-over temperature conditions by better discerning a failed EGT sensor from a true over-temperature condition, as well as increasing the engine torque available in reduced power mode after an EGT sensor FMEM event has occurred.

For the 2013 model year, Ford introduced more robust EGT sensors into vehicle production. This same level of EGT sensor was also utilized as the replacement sensor for the 2013 safety recall on ambulance package vehicles. Ford's field data indicates that the revised sensor, along with the more robust engine calibrations, reduced the rate of occurrence of SSN events for all vehicle applications by over 95%.

As part of the engineering investigation in the preparation of this response, Ford evaluated engine calibration operation while manually inserting EGT faults in every combination and condition (i.e., open, short, and out of range) for all sensor positions, conducted extensive vehicle drive evaluations while manually inserting sensor faults, evaluated warranty service data retrieved during diagnostics and repairs, analyzed parts returned from the field, and reviewed customer reports identified for this response. Ford's data analysis and testing identified that, in addition to the single open or short circuit fault in the EGT sensor downstream of the DPF addressed by 13S10, there were other sensor conditions and positions that could also initiate an EGT sensor FMEM and result in a SSN mode. In particular, Ford's analysis of the sensors with a higher time in service identified new faults in the sensor upstream of the DPF and also identified that these faults could potentially lead to a SSN condition. A summary of the conditions and system responses can be found in Appendix K. As a result, Ford determined that the remedy applied in the 2013 safety recall did not reduce the number of non-over temperature SSN events as effectively as originally anticipated.

Out of concern for the unique ambulance applications, Ford's Field Review Committee reviewed the effectiveness of the 13S10 remedy and approved a field service action (15S09) on March 16, 2015. Further, even though the field data indicates a significant reduction in non-over temperature SSN events for the 2013 and later model year ambulance and fire engine packages, out of an abundance of caution and desire to have a consistent level of engine calibration across the model years, Ford is including all 6.7L equipped ambulance and fire engine package vehicles built through January 30, 2015, when the latest EGT sensor hardware was implemented in production, in recall 15S09.

Summary

The EGT sensors provide inputs that are used for emissions purposes and to protect the vehicle from an over temperature condition in the exhaust system. The FMEM that is implemented when an over temperature condition is identified balances management of the potential over temperature condition while providing the operator the ability to continue safely operating the vehicle, under restricted conditions, until it is safe to stop the vehicle. This FMEM system alerts the operator with an audible chime that sounds five times while a "Stop Safely Now" message in the instrument cluster is illuminated. The "wrench light" in the instrument cluster also

illuminates. Engine torque is gradually reduced by 70 percent over a period of 45 seconds after which sufficient torque to continue driving the vehicle is maintained until the vehicle speed is reduced to less than approximately one mph. During this time the vehicle remains fully controllable and there is no effect on steering, braking, lighting, electrical, or any restraint system. Independent of time, when vehicle speed is reduced to less than approximately one mph, the system shuts the engine down and begins a cool down period that prevents the engine from being restarted for between 10 and 60 minutes, depending on environmental conditions. While this condition is inconvenient to operators, it is designed to balance managing the over temperature condition with providing the ability to safely maneuver the vehicle to a stop.

- Ford believes that a unique condition exists for ambulance vehicles when an FMEM caused by an EGT sensor fault can ultimately lead to an engine shut down and subsequent inability to quickly restart. In ambulance vehicles this condition could impact the ability to deliver medical treatment to a patient. Ford voluntarily implemented safety recall 13S10 due to a unique concern for a patient potentially in need of medical attention.
- For 2013 model year vehicles and newer, the revised EGT sensor implemented in production has reduced the reported occurrence of SSN events by over 95%. This improved sensor, along with the calibration robustness features that vehicles are receiving with the 14E03 emission recall, are expected to nearly eliminate the occurrence of non-over temperature SSN events caused by an EGT sensor fault.
- As part of this investigation, Ford evaluated engine calibration operation while manually inserting EGT faults in every combination and condition (i.e., open, short, and out of range) for all sensor positions, conducted extensive vehicle drive evaluations while manually inserting sensor faults, evaluated warranty service data retrieved during diagnostics and repairs, analyzed parts returned from the field, and reviewed customer reports identified for this response. Ford's data analysis and testing identified that, in addition to the single open or short circuit fault in the EGT sensor downstream of the DPF addressed by 13S10, there were other sensor conditions and positions that could also initiate an EGT sensor FMEM and result in a SSN mode. In particular, Ford's analysis of the sensors with a higher time in service identified new faults in the sensor upstream of the DPF and also identified that these faults could potentially lead to a SSN condition.
- On March 16, 2015, Ford's Field Review Committee approved safety recall 15S09 to address the unique concerns for patient safety identified and described previously. Although field data indicates a significant reduction in non-over temperature SSN events for the 2013 and later model years, out of an abundance of caution and desire to have a consistent level of engine calibration across the model years, Ford is extending that safety recall to all 6.7L equipped ambulance and fire engine package vehicles built through January 30, 2015, when the latest EGT sensor hardware was implemented in production.
- For all other 6.7L vehicle applications, Ford continues to believe that the SSN mode is robust and does not present an unreasonable risk to safety. The SSN mode provides adequate warning with an audible chime and illuminated warnings before gradually reducing engine torque over a period of 45 seconds to a level that can be maintained to allow the vehicle to be driven to a safe location before the engine is shut down.

- Furthermore, Ford introduced continuous improvement actions, including hardware and software, beginning in the 2013 model year, and is providing software enhancements to all 6.7L engine equipped vehicles in the subject vehicle population as part of proactive emissions recall 14E03.

In summary, Ford does not believe that the SSN mode presents an unreasonable risk to safety in non-ambulance and fire engine package vehicles. This position is further supported by no reports of accidents or injuries that are attributable to this condition. In addition, Ford believes that the incremental actions we have voluntarily taken appropriately address any unique concerns for patient safety associated with this condition in ambulance and fire engine package vehicles.

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