

Ford Motor Company

James P. Vondale, Director
Automotive Safety Office
Environmental & Safety Engineering

August 27, 2003

Ms. Kathleen C. DeMeter, Director
Office of Defects Investigation Safety Assurance
National Highway Traffic Safety Administration
400 Seventh Street, S.W.
Washington, DC 20590

Dear Ms. DeMeter:

Subject: EA03-004:NVS-213da

Attached is the Ford Motor Company (Ford) response to the agency's June 30, 2003 letter requesting information concerning wheel studs on 1997 through 2000 model year Ford Windstar vehicles.

As discussed in the attachment to this letter, Ford investigated allegations of wheel stud breakage on the subject vehicles both internally, and in response to both this Engineering Analysis and PE02-085. Ford concludes that there is no evidence of a systemic design, manufacturing, assembly, or quality defect leading to the reported wheel stud fractures. Rather, all information suggests that the key contributing factor to the incident reports is improper service or maintenance of the wheel attachment.

The reported incidents typically involve vehicles with more than 35,000 miles. It is very likely that vehicles with 35,000 or more miles have had the wheels removed one or more times for service to the tires, brakes, or other components. Ford's analysis of clamp load with repeated wheel removals and installations determined that clamp load remains essentially the same through numerous wheel removals and reinstallations - thus the wheel attachment will perform properly throughout the life of the vehicle if properly tightened.

As part of its investigation in response to this inquiry, Ford conducted extensive testing to determine if the subject parts are designed properly and compared the design to that of peer vehicles. The initial results of this testing show that the subject vehicle components perform equal to or better than its peer vehicles. In addition, dimensional and material comparisons show that the attachment is essentially the same as that used on peer vehicles. Details of the testing and analysis are provided in the attachment. If the agency desires, Ford would be pleased to provide further explanation of the testing completed, that in process, and Ford's future test considerations.

Ford believes there are three likely causes for the reported wheel stud fractures. First, stud fracture may occur during lug nut removal or installation when high levels of torque are inadvertently applied (during installation) or are required to overcome corrosion or dirt accumulation, or due to cross threading. Obviously, if this occurs, the need for service is apparent.

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The second possible cause of stud fracture is insufficient clamp load between the road wheel and brake rotor or drum and hub assembly, which results from failure to properly tighten the lug nut to the specified 100 ft-lb torque. If sufficient clamp load is not achieved, the normally present microscopic movement between these parts may increase to the point that the studs undergo bending loading, which may ultimately result in stud fracture. In addition, if the overt indications that accompany a loose wheel are ignored, loosely fastened lug nuts may actually "walk off" the stud resulting in wheel separation or stud damage. Torque/tension testing performed on 15-inch aluminum wheels indicates that the initial torque specification of 83-113 ft-lbs is sufficient to supply the required clamp load and prevent movement between the wheel and the brake and hub assembly. As previously noted this clamp load remains essentially unchanged through numerous wheel removals and installations at the specified torque.

The third possible cause of stud fracture is corrosion, dirt, or damage present on the road wheel at the nut interface when a wheel is reinstalled after removal. Such contamination may reduce the amount of clamp load resulting from the specified torque. In addition, corrosion and/or dirt can build up on the wheel mounting surface and rotor or drum to hub mounting surfaces, and if not removed prior to wheel installation, may cause a relaxation of clamp load and eventual stud fracture. Ford notes that a small sample of wheels and lug nuts from the field was reviewed. Corrosion in the interface area of the lug nut and wheel was found to be minimal.

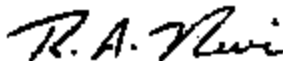
A comparison of failure rates between various wheel types indicates an increased rate of reports on aluminum wheels when compared to steel. Torque/tension analysis of the aluminum wheel design indicates the specified torque meets all design requirements.

A review of incidents involving alleged accidents attributable to the alleged defect show that none of the alleged accidents resulted in vehicle to vehicle collisions or injuries, and resulted only in minor damage to a subject vehicle. The lack of injuries, as well as the absence of car-to-car accidents, indicates that if a wheel does come off the vehicle, the operator is able to control the vehicle and avoid any other contacts.

Ford does not believe the reported events indicate the presence of a defect trend in the design, manufacture, or assembly of the wheel attachment for the subject vehicles. Rather, we believe that the reported loose attachments and stud failures are likely due to 1) improper tightening of the fasteners to the specified torque of 100 ft-lbs during the vehicle servicing that typically has occurred by the vehicle mileages at which these incidents have been alleged or 2) other improper service, such as assembling the wheel to the vehicle with excessive dirt or corrosion present. Wheel separation due to stud fractures typically is preceded by adequate warnings of noise or vibration during vehicle operation or the visual observation that a lug nut is missing or a stud is broken during other vehicle maintenance, such as brake inspection or tire rotation, or during vehicle cleaning or checking of tire pressure. For these reasons and other reasons more fully explained in the attachment to this response, Ford believes that wheel stud breakage on the subject vehicles does not constitute an unreasonable risk to motor vehicle safety.

If you have any further questions, please contact me.

Sincerely,



James P. Vondale

Attachment

FORD MOTOR COMPANY (FORD) RESPONSE TO EA03-004

Ford's response to this Engineering Analysis 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 every effort to provide thorough and accurate information, and we would be pleased to meet with agency personnel to discuss any aspect of this Engineering Analysis.

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, as more fully described in this response. 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.

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 June 30, 2003, the date of your inquiry. Ford has searched business units and/or affiliates within the following offices for responsive documents: Environmental and Safety Engineering, Ford Automotive Operations, Ford Customer Service Division, Quality, Global Core Engineering, Office of the General Counsel, and North American Car Product Development.

Request 1

State, by model, wheel type, 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. Wheel type;
- e. Model Year;
- f. Date of manufacture;
- g. Date warranty coverage commenced; and
- h. 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 2000, or a compatible format, entitled "PRODUCTION DATA." See Enclosure 1, Data Collection Disc, for a pro-formatted table that provides further details regarding this submission.

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) and its protectorates and territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and the Virgin Islands) is 811,429. The requested detailed information is provided electronically in Appendix A (file: 2003-08-27_Appendix_A) on the enclosed CD.

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, based on claims against the manufacturer involving a death or injury, notices received by the manufacturer alleging or proving that a death or injury was caused by the alleged defect in a subject vehicle property damage claims, consumer complaints, or field reports;
- d. Property damage claims; and
- 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 "d" 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" and "d" 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 potentially involving the alleged defect and any related documents, Ford has gathered "owner reports" and "field reports" maintained by Ford Customer Service Division (FCSD), Intensified Customer Concern Definition (ICCD) data maintained by Ford's Quality Office, fleet reports maintained in a Fleet Test Database, and claim and lawsuit information maintained by Ford's Office of the General Counsel (OGC).

Descriptions of the FCSD owner and field report systems, the ICCD and the Fleet Test Database systems, and the criteria used to search each of these are provided electronically in Appendix B (file: 2003-08-27_Appendix_B) on the enclosed CD.

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

<u>Category</u>	<u>Allegation</u>
A1	Alleged wheel separation caused by wheel stud fracture
A2	Alleged wheel stud fracture not causing wheel separation or looseness
A3	Alleged wheel stud fracture and alleged wheel looseness
B1	Alleged wheel separation, unknown cause*
B2	Alleged wheel fastener issues of unknown cause or ambiguous wheel stud issue*

*We are providing electronic copies of these reports 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 the alleged defect.

Owner Reports: The search and review of the Ford Master Owner Relations Systems (MORS) database records, as described in Appendix B, identified the following number of owner reports in accordance with the categories described above:

Category	A1	A2	A3
Reports	7	14	1

Copies of these owner reports and ambiguous reports are provided in the MORS II and MORS III portion of the electronic database contained in Appendix C (file: 2002-08-27_Appendix_C) on the enclosed CD. 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 is marked accordingly, and the group is 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.

Legal Contacts: Ford is providing in Appendix B a description of Legal Contacts and the activity that is responsible for this information, Litigation Prevention. To the extent that responsive (i.e., not ambiguous) owner reports reflect that they are Legal Contacts, Ford has gathered the related files from the Litigation Prevention activity. Based on this search, no responsive files were found. Ford notes that it was unable to locate one file.

ICCD Information: A search of the ICCD database as described in Appendix B did not locate any reports that may relate to the alleged defect, or any reports that are ambiguous as to whether they relate to the alleged defect.

Fleet Reports: In addition to fleet reports that may be contained in the owner reports or field reports identified in this response, Ford conducted a search of its Fleet Test Database as described in Appendix B for reports that may relate to the alleged defect in the subject vehicles. No fleet reports were identified.

Field Reports: The search and review of the Ford Common Quality Indicator System (CQIS) records, as described in Appendix B, identified the following number of field reports, excluding duplicates, in accordance with the categories described above:

CQIS

Category	A1	A2	A3
Reports	1	2	0

Copies of these field reports and ambiguous reports are provided in the CQIS portion of the electronic database contained in Appendix C on the enclosed CD. The categorization of each report is identified in the "Category" field. When we were able to identify that responsive (i.e., not ambiguous) duplicate field reports for an alleged incident were received, each of these duplicate reports is marked accordingly, and the group is 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. In addition, none of these CQIS reports are duplicative of responsive owner reports.

Unified Database: The Unified Database (UDB) was created to facilitate parts availability by tracking part sales and is not intended as a problem reporting system. However, because a small percentage of the records may contain verbatim comments that could potentially relate to the agency's inquiry, we are including these in response to Request 2. Nonetheless, a search of UDB, as described in Appendix B, was conducted. Copies of potentially relevant reports and ambiguous reports are provided in the UDB portion of the electronic database contained in Appendix C on the enclosed CD.

UDB

Category	A1	A2	A3
Reports	5	96	7

The categorization of each report is identified in the "Category" field. When we were able to identify that responsive (i.e., not ambiguous) duplicate UDB reports for an alleged incident were received, each of these duplicate reports is marked accordingly, and the group is 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. In addition, none of these UDB records are duplicative of responsive warranty reports.

VOQ Data: This information request had an attachment that included six Vehicle Owner's Questionnaires (VOQs). Ford made inquiries of its MORS database for customer contacts, and its CQIS database for field reports regarding the vehicles reflected on the VOQs. Ford notes that in some instances, where the VOQ does not contain the VIN, or the owner's last name and zip code, it is not possible to query the databases for owner and field reports specifically corresponding to the VOQs. As a result, Ford was unable to query two of the VOQs due to lack of VIN. Any reports located on a vehicle identified in the VOQs related to the alleged defect are included in the MORS and CQIS portions of the electronic database provided in Appendix C and have been identified by a "Y" in the "VOQ Dup" field.

Crash/Injury Incident Claims: For purposes of identifying alleged accidents or injuries potentially related to the alleged defect, Ford has reviewed responsive (i.e., not ambiguous) owner and field reports, lawsuits and claims, and warranty claims. Based on a reasonable and diligent search, Ford located 4 owner (MORS) reports [VINS: 2FMDA5142WBB62499, 2FMZA5148WBE16447, 2FMDA5144WBA89984, 2FMDA5348XBB55229], no field (CQIS) reports, no warranty claims, and 2 lawsuits and claims [VINS: 2FMDA5146WBA56072, 2FMZA5141WBD54311], alleging an accident that may be related to the alleged defect. The owner and field reports and warranty claims are included in the MORS, CQIS, and Analytical

Warranty System (AWS) portions of the electronic database provided in Appendix C. Lawsuit and claim information is provided as described below.

The four owner reports listed in the preceding paragraph that contain allegations of accidents or injuries potentially related to the alleged defect were further investigated. None of the four vehicles were involved in vehicle-to-vehicle collisions nor are any injuries alleged. Three of the claims involved damage only to the involved vehicle, and the fourth involved alleged damage to two nearby vehicles in which operators, while observing the alleged incident, simply collided with each other.

Claims, Lawsuits, and Arbitrations: For purposes of identifying incidents potentially related to the alleged defect, 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.

Based on a reasonable and diligent search, Ford located no lawsuits, two claims, no consumer breach of warranty lawsuits, and no arbitrations that appear to relate to the alleged defect in the subject vehicles. Ford did not locate any ambiguous lawsuits, claims or consumer breach of warranty lawsuits. We are providing the requested detailed information, where available, on the responsive claims in our Log of Lawsuits and Claims, as Appendix D (file: 2003-08-27_Appendix_D). With regard to these lawsuits and claims, Ford has not undertaken to contact outside law firms to obtain additional documentation.

Both claims resulted in damage only to the vehicle with the alleged defect, and did not involve vehicle-to-vehicle accidents or injury allegations.

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 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), 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 2000, or a compatible format, entitled "REQUEST NUMBER TWO DATA." See Enclosure 2, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer

As indicated in response to Request 2, Ford has provided related owner complaints and field reports in the electronic database contained in Appendix C. Ford assumes that providing the complaints and reports in the electronic database format meets the requirements of this request because the agency can review or order the claims as desired.

Request 4

Produce copies of all documents related to each item within the scope of Request No. 2 that were not provided in Ford's response of February 12, 2003 to PE02-085. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method Ford used for organizing the documents.

Answer

As indicated in response to Request No. 2, Ford has provided related owner complaints and field reports in the electronic database contained in appendix C. Ford assumes that providing the complaints and reports in the electronic database format meets the requirements of this request because the agency can review or order claims as desired.

Request No. 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; claim 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.

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

- a. Ford's claim number;
- b. Vehicle owner or fleet name (and fleet contact person) 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;
- h. Problem code;
- i. Replacement part number(s) and description(s);
- j. Concern stated by customer; and
- k. Comment, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2000, or a compatible format, entitled "WARRANTY DATA." See Enclosure 2, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer:

In responding to this information request, Ford electronically searched its Analytical Warranty System (AWS) for all claims meeting the criteria described in Appendix B. The resulting claims were then reviewed individually for allegations that may relate to the alleged defect. This search and review of the Ford AWS database records identified the following number of non-duplicative warranty claims in accordance with the categories described above:

Category	A1	A2	A3
Reports	0	57	0

Electronic copies of these claims and ambiguous claims are provided in the AWS portion of the electronic database contained in Appendix C. The categorization of each report is identified in the "Category" field. When we were able to identify that duplicate claims for an alleged incident were received, each of these duplicate claims is marked accordingly and the group is 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. Also, two of the category A2 warranty claims are duplicative of three category A2 field reports and none of the owner reports. These claims are provided in Appendix C but are not reflected in the report count above.

The requested customer concern codes and the warranty condition codes are provided in Appendix B.

Requests for "goodwill, field, or zone adjustments" received by Ford to date that relate to the alleged defect in the subject vehicles that were not honored, if any, would be indicated in the MORS reports identified above in response to Request 2. Requests for goodwill that were honored, if any, are contained in the warranty data provided.

Request 6

Describe in detail the search criteria used by Ford to identify the claims identified in response to Request No. 6, including the labor operations, problem codes, part numbers and any other pertinent parameters used. Provide a list of all labor operations, labor operation descriptions, problem codes, and problem code descriptions applicable to the alleged defect in the subject vehicles. State, by make and model year, the terms that Ford offers for new vehicle warranty coverage 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) related to the alleged defect 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

The search criteria used to identify the claims counted and listed in response to Request 5 are provided in our response to that request. As also indicated in that response, the pertinent parameters and code descriptions are provided in Appendix B.

The standard new vehicle warranty coverage for 1997 through 2000 model year Windstar vehicles is three years or 36,000 miles, whichever occurs first. Ford has not attempted to

gather the additional extended warranty coverage option information requested because none of the warranty options sold by Ford cover wheel studs unless they were replaced as part of the wheel hub assembly. Ford does not have information concerning extended warranty plans sold outside the Ford option programs.

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 office, or field offices pertaining, at least in part, to the alleged defect in the subject vehicles, 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 the 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, Internal Service Messages, and the Field Review Committee files and the search criteria used are provided in Appendix B.

OASIS Messages: Ford has identified no SSMs and no new TSBs that may relate to the alleged defect in the subject vehicles. Copies of two TSBs that may relate to the alleged defect were provided in the PE investigation.

Internal Service Messages: Ford identified no ISMs that may relate to the alleged defect in the subject vehicles.

Field Review Committee: Ford identified no field service action communications that may relate to the alleged defect in the subject vehicles.

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. 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 is providing a table in Appendix E (file: 2003-08-27_Appendix_E) on the enclosed CD that describes all assessments, analyses, test, test results, studies, surveys, simulations, investigations, inquiries or evaluations that relate to the alleged defect that have been conducted or are planned specifically for this Engineering Analysis. The corresponding analyses are provided with a request for confidentiality under separate cover as Appendix E1 to the NHTSA's Office of the Chief Counsel pursuant to 49 CFR, Part 512. Previous assessments have been submitted in our response to PE02-085.

Ford is construing this request broadly and providing studies, surveys, and investigations related to the alleged defect, and 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 J. Ford is not providing documents responsive to this request that contain information protected by the attorney-client privilege and/or work-product doctrine. Such documents are described in a privilege log provided in Appendix L (file: 2002-08-27_Appendix_L) on the enclosed CD.

Ford will be submitting additional related documentation with a request for confidentiality under separate cover as Appendix M to the NHTSA's Office of the Chief Counsel pursuant to 49 CFR, Part 512.

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, 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 numbers (service and engineering) of the original component;
- e. The part number (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
- k. 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

A table describing changes in addition to those provided in the response to PE02-065 is provided electronically as Appendix F (file: 2003-08-27_Appendix_F) on the enclosed CD. None of the changes appear to be related to the alleged defect.

Request 10

State the number of each of the following, components that Ford has sold for use or possible use in the subject vehicles by part 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:

- a. Wheel studs;
- b. Wheel nuts;
- c. Front wheel hubs; and
- d. 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-Mercury dealers. Ford has no means by which to determine how many of the parts were actually installed on vehicles, the vehicle model on which a particular part was installed, or the reason that the installation was made.

Ford is providing in electronic form in Appendix G (file: 2003-08-27_Appendix_G) on the enclosed CD the total number of Ford service replacement wheel studs, wheel nuts, and front wheel hubs sold by Ford to dealers by part number (both service and engineering) and calendar month and year of sale, where available. A list of models and model years for which these parts are released and supplier names and contacts are also provided in this appendix.

Note that this electronic file is inclusive of all parts sold and should not be added to sales numbers that were reflected in the PE investigation.

Request 11

Furnish copies of all engineering standards, performance specifications, quality assurance specifications, and documents related to validation testing for the subject components and for stud/nut fasteners in general.

Answer

The requested standards, specifications, and documents within Ford's possession, custody or control, located pursuant to a diligent search, will be provided to the NHTSA's Office of the Chief Counsel under separate cover with a request for confidentiality as Appendix M1.

Request 12

Coordinate with ODI in the real-time identification of subject vehicles that are at Ford dealerships for repairs of wheel stud failures with the objective of capturing parts of interest before they are damaged by service repairs.

Answer

Ford has instituted a parts return policy for the purpose of collecting data on the alleged defect. Parts returned will be analyzed to determine the root cause of the alleged defect. Previous analysis of returned parts has been submitted with the earlier investigation showing all materials to meet specifications.

Real-time identification of subject vehicles that are at Ford dealerships for repairs of wheel stud failures is difficult due to the nature of the repair itself. In most cases, by the time a vehicle is identified, the repair will be complete and the vehicle will have left the dealership.

Ford will continue to monitor returned parts regarding the alleged defect.

Request 13

State the basis for each specification and performance standard related to durability and provide the following additional information regarding the durability of the subject components:

- a. State whether and how the specification addresses the effect of torque relaxation;
- b. State how the specification addresses factors related to removal and reinstallation of wheels; and
- c. Identify the significant aging effects acting on the subject components in field service, including environmental and use factors, and state how Ford's testing and specifications addresses each.

Answer

A table of the requested specifications and performance standards is provided electronically as Appendix H (file: 2003-08-27_Appendix_H) on the enclosed CD, which addresses testing that relates to the lug nut, wheel, and stud system. The relationship to torque relaxation, removal and reinstallation of wheels, and aging and use factors is also described in Appendix H.

Request 14

Provide copies of all documents relating to communications between Ford and each supplier of the subject components.

Answer

All documents relating to communications responsive to this investigation are included in the response to Request 8.

Request 15

Provide a table showing the following information for each wheel type used as original equipment in the subject vehicles:

- a. The part numbers for the wheel, stud, and nut;
- b. The number of vehicles sold with the wheel type by model year;
- c. The number of incidents identified from all sources that involve (1) wheel stud failure and (2) wheel separation due to stud failure, by model year and age interval (use the following age intervals: 0 to 15,000 miles, 15,000 to 30,000 miles, and greater than 30,000 miles);
- d. The failure rates and Ford's assessment of which, if any, of the wheel types used in the subject vehicles show significantly greater rates of field failure experience than any of the other wheel types overall or in any of the stated age intervals; and
- e. Ford's assessment of the reasons why any of the subject wheel types exhibit greater failure rates than others and why any of the subject wheel types may experience higher rates of failure than wheel studs in peer minivans of similar age.

Answer

A table of the requested information is provided electronically as Appendix I (file: 2003-08-27_Appendix_I) on the enclosed CD. Incidents and failure rates for each of the wheels are included in the table.

The aluminum wheels in each of the model years and mileage bands show higher rates than their comparable steel wheels. Torque/tension testing was conducted on the aluminum wheels with the highest report rate to verify all applicable design parameters with regards to the wheel, nut, and stud joint. All testing confirmed that the design meets all performance specifications for this type of application. Data for this testing is provided in the answer to Request 16.

Ford also notes that the 16 inch Aluminum wheel for 1998 model year has a higher report rate as compared to other wheels. This wheel had a limited number of reports, but is also a low volume wheel, which is contributing to the high report rate numbers. Ford plans to perform torque/tension testing on this 16 inch wheel to confirm that all design specifications are met.

Ford has no data to compare the Windstar report rate to that of "peer" minivans. Ford has conducted comparative analysis of the Windstar wheel/stud/nut joint with available information for the joints of peer minivans. The analysis indicates that Ford's joint design is robust when tightened to specifications. Data also showed that the Ford joint performance is very similar to that of General Motors, and more robust than the joint used by Daimler Chrysler.

Request 16

Provide the following information regarding wheel nut/stud torque requirements for the subject vehicles by wheel type and model year:

- a. State the torque specifications;
- b. State the minimum clamping load for each nut to adequately secure the wheel to the vehicle;
- c. State the minimum torque necessary to achieve and maintain the clamping load stated in
- d. State the maximum torque that the parts can receive without stud damage;
- e. Data regarding torque retention vs. time and wheel cycles for each combination of wheel, stud, and nut used in the subject vehicles;
- f. Describe the effect of dirt, corrosion, or other use factors on the nut torque required for item 18.c.; and
- g. Provide copies of all documents related to items 18.a through 18.f.

Answer

- a) Torque specification is nominally 100 ft-lbs on all nut and wheel combinations (production range: 83-113 ft-lbs.)
- b) The minimum clamp load per wheel stud/lug nut pair is estimated to be 2,900 lbs. This estimate is based on the assumptions for friction between the rotor and hub, the hub and wheel, the lug nut and wheel, and the lug nut and stud. It also assumes a worst-case longitudinal brake force and worst-case impact loads at the wheel.
- c) Using the same calculation assumptions as in 18b, the minimum torque necessary to achieve the estimated clamp load would be 50 ft-lbs.
- d) The proof load that the studs can withstand without acquiring a permanent set is 12,311 lbs. Using the same calculation assumptions as 18b, the torque necessary to achieve the estimated clamp load would be 213 ft-lbs.
- e) Torque/tension testing was performed on what Ford considers the wheel with the highest number of repairs and on peer minivan wheels. Clamp load in the joint is considered sufficient after 30 on/off tests. Data is provided with a request for confidentiality under separate cover as Appendix M2 to the NHTSA Office of the Chief Counsel pursuant to 49 CFR, Part 512. Post corrosion testing is planned to be conducted in September 2003.
- f) Noise factors such as corrosion or dirt between the wheel stud and lug nut and the lug nut and wheel will change the "K" factor (effective friction) for the joint during re-installation. These types of noise factors are controlled at Ford by coating selection and design factor relative to the joint tension requirement and the joints minimum tension capability. The Windstar joint has a design factor of 1.46 times the nominal requirement. Service concerns such as the addition of motor oil or other lubricant to the wheel stud/lug nut system during service would increase the tension in the joint thus enhancing wheel retention. The concern with the application of lubricants to the stud lug nut system is the possibility of over stressing the stud during re-installation.
- g) Documents relating to the torque/tension testing are provided with a request for confidentiality under separate cover as Appendix M2 to the NHTSA Office of the Chief Counsel pursuant to 49 CFR, Part 512.

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