Wayne Bahr, Global Director
Automotive Safety Office
Sustainability, Environment & Safety Engineering

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

July 2, 2015

Mr. Frank S. Borris, Acting Associate Administrator, Enforcement
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE, Room W45-302
Washington, DC 20590

Dear Mr. Borris:

Subject: PE15-017:NVS-213cnl

The Ford Motor Company (Ford) response to the Agency's May 14, 2015 letter concerning reports of alleged failure of front jounce brake hose resulting in brake fluid leakage, extended brake pedal travel and/or extended stopping distance in Ford Explorer Police Interceptor vehicles is attached.

The Agency opened this investigation based on a VOQ report from a police fleet in Sacramento, California. Ford believes that the failures reported by the Sacramento Police Department are the result of the extreme usage and duty cycle unique to the Sacramento Police Department's pursuit training course and not a design or manufacturing defect. This assessment is based on the following:

- Analysis of parts returned from the Sacramento vehicles revealed damage caused by extremely high heat.
- Ford was able to reproduce this extreme heat by duplicating the City of Sacramento's unique pursuit training course and driving procedure.
- All three VOQ complaint vehicles were used for training on this same course.
- Ford found no evidence of any similar failures and only 28 reports related to the front brake jounce hose for any reason on more than 568,000 subject and peer vehicles.

In addition, Ford's testing has also shown that even if a jounce hose failure did occur, the design of the brake system on the subject vehicles is more than adequate to safely stop the vehicle. This, combined with report verbatims indicating that a low brake fluid condition is overt to the driver (with audible and visual low fluid warnings), and no allegations of accidents or injuries attributed to this condition, supports Ford's belief that there is no evidence demonstrating a defect in the design or construction of the subject brake hose. Ford believes that consideration of all of these findings support a conclusion that there is no unreasonable risk to motor vehicle safety associated with this subject in these vehicles.

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

Sincerely,

for Wayne Bahr

Attachment

ATTACHMENT
July 2, 2015

FORD MOTOR COMPANY (FORD) RESPONSE TO PE15-017

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 documents dated up to and including May 14, 2015, the date of your inquiry. Ford has searched within the following offices for responsive documents: Ford Customer Service Division, Office of the General Counsel, and North American Product Development.

Request 1

State, by model and model year, and service application (e.g., Police Interceptor or civilian vehicle) the number of subject 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 (VIN);
b. Make;
c. Model;
d. Model Year;
e. Date of manufacture;

f. Service application (Police Interceptor or civilian vehicle);
g. Fleet name (Police Interceptors only);
h. Front brake hose part number, left;
i. Front brake hose part number, right;
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 2007, or a compatible format, entitled "PE15-017 PRODUCTION DATA." See Enclosure, a Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer

Ford notes that the subject brake hose was used on all 2013 through 2015 Ford Explorer vehicles produced on or after June 25, 2012. Due to the many differences between the Police and Non-Police vehicles and corresponding duty cycles; Ford included all Police Interceptor models that use the subject component as "subject vehicles" and all Non-Police Interceptor models that use the subject component as "peer vehicles".

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 49,732.

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

Model	2013 MY	2014 MY	2015 MY
Ford Explorer Police Interceptor	10,258	19,199	20,275

Ford records indicate that the approximate total number of peer 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 518,811.

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

Model	2013 MY	2014 MY	2015 MY
Ford Explorer Non-Police Interceptor	162,804	188,716	167,291

The requested data for each subject and peer vehicle is provided in Appendix A.

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 and peer 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 a possible defect in a subject vehicle, property damage claims, consumer complaints, or field reports;
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 "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" 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 relate 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:

Category	Allegation
A1	Brake fluid leakage due to failure of the Front Jounce Hose
A2	Extended brake pedal travel due to failure of the Front Jounce Hose
A3	Extended stopping distance due to failure of the Front Jounce Hose
A4	Other symptom due to failure of the Front Jounce Hose
B1	Brake fluid leakage, causal part not identified
B2	Extended brake pedal travel, causal part not identified
B3	Extended stopping distance, causal part not identified

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 the alleged defect.

Owner Reports: Records identified in a search of the FMC360 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 that allege failure of the front brake hose resulting in brake fluid leakage, extended brake pedal travel and/or extended stopping distance in a subject or peer 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.

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.

Legal Contacts: Ford is providing, in Appendix B, a description of Legal Contacts and the activity that is responsible for this information. Ford has not identified any Legal Contacts that are responsive to the Agency's request.

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 failure of the front brake hose resulting in brake fluid leakage, extended brake pedal travel and/or extended stopping distance in a subject or peer 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.

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. In addition, field reports that are duplicative of owner reports are provided in Appendix C but are not included in the field report count.

VOQ Data: This information request had an attachment that included one Vehicle Owner Questionnaire (VOQ) containing three VINs. The single VOQ (#10705832) stated that the brake line on the front passenger side and front driver's side "fractured" on these vehicles. Two of these vehicles were reported as belonging to the Sacramento City Fleet and one was reported as a Regional Transit Vehicle. Ford made inquiries of its FMC360 database for customer contacts, and its CQIS database for field reports regarding the vehicles identified on the VOQs. In April 2015, the City of Sacramento Police Department also contacted Ford's fleet representative regarding three leaking front jounce hoses. All three reports indicated a brake fluid leak with two of them also reporting extended brake pedal travel due to the left and/or right front brake jounce hose pulling away from the crimp joint.

Crash/Injury Incident Claims: Ford has not identified any allegations of accidents or injuries that may have resulted from the alleged defect.

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.

Ford notes that we did not locate any responsive lawsuits and claims; however, we are providing the requested detailed information, where available, on the ambiguous lawsuits and claims in our Log of Lawsuits and Claims, provided in Appendix C in the Legal Claim/Lawsuits tab. The number of relevant lawsuits and claims identified is also provided in this log. To the extent available, copies of complaints, first notices, or FMC360 reports relating to matters shown on the log are provided in Appendix D. With regard to these lawsuits and claims, Ford has not undertaken to contact outside law firms to obtain additional documentation.

Request 3

Separately, for each item (complaint, report, claim, notice, or matter) within the scope of your response to Request No. 3, 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. Vehicle's speed at time of incident;
h. Incident date;
i. Report or claim date;
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 2007, or a compatible format, entitled "PE15-017 REQUEST NUMBER THREE DATA" See Enclosure, a Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

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 C in the Legal Claim/Lawsuits tab.

Request 4

Produce copies of all documents related to each item within the scope of Request No.3. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method Ford used for organizing the documents.

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 shown on the Log of Lawsuits and Claims provided in Appendix C in the Legal Claim/Lawsuits tab are provided in Appendix D. To the extent information sought in Request 4 is available, it is provided in the referenced appendices.

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 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.

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;
k. Was vehicle towed in; and
l. Comment, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2007, or a compatible format, entitled "PE15-017 WARRANTY DATA." See Enclosure, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

Answer

Records identified in a search of the Analytical Warranty System (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 failure of the front jounce brake hose resulting in brake fluid leakage, extended brake pedal travel, and/or extended stopping distance in a subject or peer 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.

When we were 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. Warranty claims that are duplicative of owner and field reports are provided in Appendix C but are not included in the report count above.

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.

Ford assumes that providing the warranty claims in the electronic database format meets the requirements of this request because the Agency can review or order the claims as desired.

Additionally, the Agency has requested information related to claims for vehicle towing as a result of an issue with the subject component. Ford provides roadside assistance as part of the new vehicle limited warranty and certain optional extended service plans. The roadside assistance program is administered by an outside supplier and Ford does not have access to claims made for vehicle towing through this service. Recently, Ford has begun importing roadside assistance claims into its FMC360 database. However, the claims do not indicate what type of assistance was required, only that assistance was requested. The customer and technician comments provided with warranty claims provide the best source of information regarding possible incident-related vehicle towing.

Ford has reviewed subject and peer vehicle reports and did not find any additional information where a vehicle has been towed, other than that contained in the VOQ provided with this information request.

Request 6

> Describe in detail the search criteria used by Ford to identify the claims identified in response to Request 5, 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 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

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.

For the 2013 through 2015 model year Ford Explorer Police Interceptor 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. No Optional Extended Service Plans that include coverage for the front brake jounce hose are available on the Ford Explorer Police Interceptor.

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 failure of the front jounce brake hose resulting in brake fluid leakage, extended brake pedal travel, and/or extended stopping distance, 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 FRC files and the search criteria used are provided in Appendix B.

OASIS Messages: Ford has not identified any SSMs or TSBs that may relate to the Agency's request.

Internal Service Messages: Ford has not identified any ISMs 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 any communication related to the alleged defect that is the subject of NHTSA's investigation.

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 and peer 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 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 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 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 F – Redacted.

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 components, from the start of production to date, which relate to, or may relate to, the alleged defect or subject condition 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. The applicable models;
c. A detailed description of the modification or change;
d. The reason(s) for the modification or change;
e. The part number(s) and a description (service and engineering) of the original components;
f. The part number(s) and a description (service and engineering) of the modified components;
g. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
h. When the modified component was made available as a service component;
i. A photograph or graphic showing each component, highlighting the design features that may relate to the alleged defect or subject condition; and
j. 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 is providing a table summarizing the requested changes in Appendix G.

Ford currently has no plans for production modifications related to the subject components in the subject vehicles.

Request 10

State the number of subject components 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 the sale (including the cut-off date for sales, if applicable).

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 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 front brake jounce hose assemblies by part number (both service and engineering) and year and month/year of sale, where available, and supplier point of contact information in Appendix H.

Request 11

Provide the following design and component information related to the alleged defect:

a. Provide copies of all Ford specifications and design requirements for the subject components;
b. Describe the construction and material composition of the subject components;
c. Describe all quality control requirements and procedures for the subject components and provide copies of all related documents from the production period associated with the incident vehicles identified in the attachment to this letter;
d. State the design requirements for pull-out forces for the caliper-side and body-side crimp connections and provide a description of how the forces were determined and the operating conditions under which the forces occur;
e. State the maximum separation forces acting on each crimp connection in services, including a description of how the forces were determined and the operating conditions under which the forces occur;
f. Provide graphs showing vehicle deceleration as a function of brake fluid pressure at the subject components for both Police Interceptor and civilian applications, if different; and
g. Provide graphs showing vehicle deceleration as a function of brake pedal application force in both normal/full system configuration and with a failed subject component (hose pulled free of caliper crimp), for both Police Interceptor and civilian applications, if different.

Answer

Ford is providing specifications and design requirements for the subject components 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.

For the 2013 through 2015 model years, Hitachi manufactured the subject front brake jounce hose assembly which consists of several components. A block fitting and flow bolt; located on the caliper end of the assembly, provides a means of attachment between the hose and the brake caliper and allows for the transfer of fluid pressure from the master cylinder to the brake caliper. The brake hose, which is attached to the block by means of a crimped ferrule, is constructed of five layers: the Inner Tube carries the brake fluid; an Inner Braid provides the structure to hold internal pressure; a Friction Layer prevents the two braid layers from rubbing together; an Outer Braid provides additional structure to hold internal pressure; and an Outer Cover which protects the Outer Braid from the elements. The brake hose must comply with the requirements of Federal Motor Vehicle Safety Standard (FMVSS) 106 for hose expansion, burst strength, tensile strength, and whip resistance. The body end of the front brake jounce hose is attached to an end fitting by means of a crimped ferrule. The end fitting is affixed to a stamped steel bracket that mounts to the vehicle body.

Ford is providing quality control requirements and procedures for the subject components and related documents from the production period associated with the brake jounce hoses installed on the Sacramento Police fleet 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.

Measurements were taken from the production period associated with the subject Sacramento Police fleet vehicles built in the month of August of 2014. The minimum measured pull-out force recorded was 652 lbf, with the average pull-out force equal to 741 lbf. Both of these measured values are well above Ford's minimum specification for a properly crimped joint.

A load cell was used to measure the maximum separation forces acting on the crimp joint at both static and dynamic conditions. The maximum static tensile load measured at full lock steering and full rebound at the crimp joint was a pull of 11 lbf. During dynamic testing, the maximum force recorded at the crimp joint during aggressive driving was approximately 5 lbf of pull.

All test results and measurements discussed above, along with the requested vehicle deceleration graphs, have been provided in Appendix I. Ford notes that the requested vehicle deceleration information demonstrates that the subject vehicle performs well within the requirements of Federal Motor Vehicle Safety Standard (FMVSS) 135 for light vehicle braking performance even in the event of a complete hydraulic brake circuit failure.

Request 12

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

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

Answer

Background

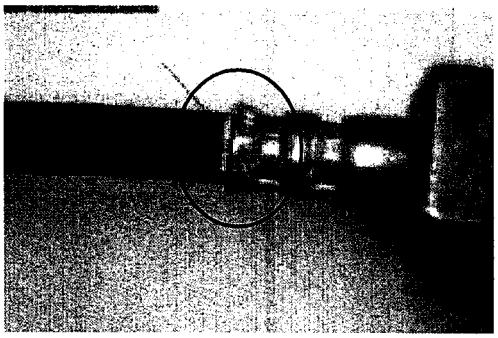
The Ford Explorer was originally equipped with a 4-wheel standard duty brake system starting in the 2011 model year and continued through the 2012 model year. Beginning with the 2013 model year, Ford offered an Explorer Police Interceptor version. All Explorer Police Interceptors were equipped with a 4-wheel heavy duty brake system that included larger mass rotors, larger brake calipers, and heavier duty pads for high performance applications. For the 2013 model year, Ford expanded the application of the 4-wheel heavy duty brake system as standard equipment on Explorer XLT, Explorer Limited, and Explorer Sport versions beginning in September 2012. The 4-wheel standard duty brake system remained as standard equipment on base trim level Explorer vehicles. The subject brake jounce hose is utilized on both systems for all 2013 through 2015 model year Explorers produced on or after June 25, 2012.

Ford introduced a new brake jounce hose for the 2016 model year Explorer that included a banjo tube at the current crimp location and a slightly longer hose due to routing changes necessary to accommodate the addition of a ride height sensor. These hoses are currently being used in production and are in the process of replacing the previous service part as the sole service part, common for all 2011 through 2016 model year Ford Explorer vehicles.

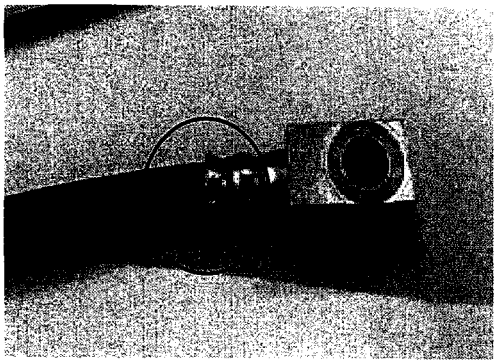
Investigation

On April 16, 2015, the City of Sacramento Police Department contacted Ford's fleet representative regarding potential leaks of the front brake jounce hoses on their 2015 model year Ford Explorer Police Interceptor training vehicles. The Sacramento Police Department reported repairs on three vehicles to the Agency in a single Vehicle Owner Questionnaire (VOQ #10705832). Two of these vehicles were used as officer training vehicles and one was reported as a regional transit vehicle (Ford later learned that this vehicle had also been used as an officer training vehicle). Ford records show that one of the training vehicles reported leaking brake fluid with a replacement of the left front brake jounce hose. The other training vehicle had reported brake fluid leaks along with brake concerns. This vehicle had the left side hose replaced and, after an inspection revealed the start of a small leak on the right side, it was replaced as well. The last training vehicle, originally listed as a regional transit vehicle, reported a brake fluid leak along with reduced brake performance characterized by mention of "no brakes" on two occasions, resulting in both the left and right front brake jounce hoses being replaced approximately four months apart.

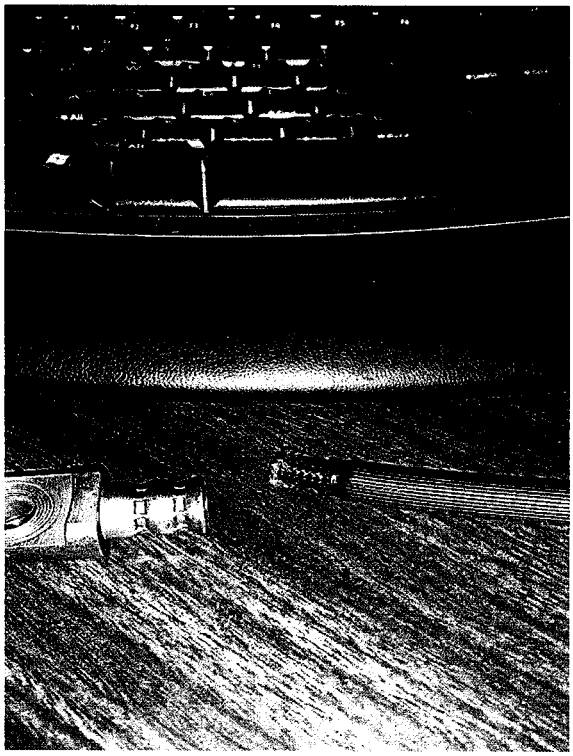
In an effort to obtain field parts for analysis, Ford contacted the servicing dealer of the Sacramento Police Department on April 21, 2015, and provided 2016 level service replacement hoses in exchange for the subject hoses from the Sacramento fleet. In each case, the returned hose at the crimp joint on the caliper side was either partially or fully pulled away as shown respectively in Photographs 2 and 3 below. Ford notes that there were no reported leaks or damage to the crimp joint on the body side of any of the returned hoses.



Photograph 1 – Properly Crimped Joint



Photograph 2 – Partially Pulled Away Joint on Returned Part



Photograph 3 – Fully Pulled Away Joint on Returned Part

Analysis and Testing

Measurements confirmed that the crimp diameter and hose length for each of the returned parts were within design specifications. Quality data obtained from the plant during the appropriate production assembly hose build dates showed an average tensile pull of 739 lbf for hoses produced during that time; well above Ford's minimum specification for a properly crimped joint. As stated in Ford's response to Request 11, the maximum static tensile load measured at full lock steering and full rebound at the crimp joint was 11 lbf of pull. During dynamic testing, the maximum force recorded at the crimp joint during aggressive driving was approximately 5 lbf of pull.

Further analysis using Scanning Electron Microscopy (SEM) on the end of the hose that had fully pulled away at the crimp fitting on the caliper side as shown above in Photograph 3 revealed extreme heat damage to the hose. The braided portion of the hose was frayed and melted while the outer cover was charred and melted. Ford's analysis and test results, along with the above pull-out force data, have been provided 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.

The Michigan State Police and the California Highway Patrol conduct annual testing of police vehicles used to certify various makes and models of vehicles as pursuit vehicles. These results are published and generally accepted by police fleets around the country. Ford conducts development testing using the same pursuit certification course and procedure. During this testing the peak temperature Ford observed on the subject brake hose was 118°C (244°F) with no observed leaks or failures of any kind. Ford notes that development testing showed that a typical Non-Police customer drive cycle generates a maximum temperature measured at the crimp joint of approximately 60°C (140°F).

In an effort to determine the cause of the extreme heat identified from the returned parts, Ford replicated the pursuit training course that was used when the reported leaks occurred at the crimp joint on the subject hoses. Ford then conducted the driver training day procedures of the Sacramento Police Department with an instrumented Ford Explorer Police Interceptor equipped with the subject hose. When a full training day consisting of multiple laps with idle time in between was performed, the crimp joint temperature rose to a peak of 172°C (342°F). This nearly 50% increase in temperature above what is generated during the generally accepted pursuit certification course for all makes and models of police vehicles across the country demonstrates that this extreme temperature condition is unique to the Sacramento Police Department's pursuit training course.

Ford notes that in addition to this extremely high heat generation, testing also revealed that the Sacramento Police Department training course resulted in an abnormally high number of electronic brake pressure impulses from repeated activation of the vehicle's Anti-Lock Braking System (ABS) and Roll Stability Control (RSC). Ford believes these additional forces are also contributing factors to potential leaks developing at the crimp joint.

While working with the police fleet, Ford conducted testing on the current 2016 model year service part that was provided to the Sacramento Police Department when harvesting the subject parts. Duplicating the same testing described above, this testing resulted in a significant decrease in temperature to a peak of 109°C (228°F). Ford notes that there have been no follow-up complaints or claims from the fleet. A summary of this and the above testing has been provided in Appendix I.

Ford also tested the subject brake hose at varying temperatures to assess the effect of these elevated temperatures on pull-out force. When the crimp joint is subjected to extreme heat for prolonged periods of time, the hose material inside the crimp joint may soften, thereby reducing the pack-force of crimping. Ford believes this reduced pack-force, in combination with the added forces of multiple electronic brake impulses from ABS/RSC activation that occurred during the unique driver training testing, created the potential for these leaks to occur. The results of this testing has also been provided in Appendix I.

As previously mentioned, discussions with officials from the Sacramento Police Department and the City of Sacramento revealed that the third vehicle, currently used as a regional transit vehicle, was also previously used as a training vehicle and subjected to the same pursuit training course and procedures as that of the Sacramento Police Department.

Field Data Analysis

Ford conducted an extensive search of consumer complaints, field reports, lawsuits and claims, and warranty claims for reports alleging leakage, extended brake pedal travel or extended stopping distance related to the front brake jounce hose on the subject and peer vehicles and identified a total of 28 reports. Of these reports, 14 were on Explorer Police Interceptor units and the remaining 14 reports were on non-Police Interceptor Explorer units. Ford did not identify any consumer complaints or repeat repairs.

Of the 14 Ford Explorer Police Interceptor reports, four reports originated from the Sacramento Police Department. The demands created by the unique training course and procedure, led to hose replacements very early in the life of the vehicle at mileages of 282, 340, and 1871 miles. Of the remaining 10 reports, six identified a vehicle repair due to an observation of a front brake jounce hose leak, two mentioned a bulge or bubble in the hose, one alleged a "missing" hose, and the last report alleged reduced brake performance characterized by mention of "no brakes." This small number of reports resulted in a time adjusted rate of 0.18 R/1000 for the subject vehicles with no allegations of accidents or injuries related to this condition.

A review of the 14 reports identified on non-Police Interceptor vehicles yielded similar results: a total of 12 reports mentioned a malfunction indicator lamp and/or a hose leak; one indicated a low pedal feel; and one alleged a reduction in brake performance characterized by mention of "no brakes." The time adjusted rate of these 14 non-Police Interceptor Explorer reports is 0.02 R/1000 with no allegations of accidents or injuries related to this condition.

As evidenced by the nature of these allegations on both the subject and peer vehicles, Ford believes that if a failure of the front jounce hose were to occur for any reason, the driver would receive a malfunction indicator lamp or notice a leak prior to experiencing any significant degradation in braking performance. Additionally, the Ford Explorer is equipped with a diagonally split brake system, where the left front brake and right rear brake are coupled on one hydraulic circuit and the right front brake and left rear brake are coupled on the other hydraulic circuit. In the event a front brake jounce hose ruptures, causing a leak of brake fluid, some braking function would remain on the affected half of the hydraulic circuit until all the brake fluid was drained. The unaffected half of the hydraulic circuit would remain fully functional. Ford's brake testing (provided in response to Request 11) shows that even if a jounce hose failure occurred, the vehicle braking performance is well within the regulatory requirements for brake performance.

Conclusions

Analysis of the returned parts from the Sacramento Police Department identified the root cause of the failure as exposure to extreme heat at the jounce hose crimp joint on the caliper side in combination with the added force of multiple electronic brake impulses resulting from their unique driver training course and procedures. In addition, all four reports related to the alleged defect from the Sacramento Police Department involved vehicles that were either currently or previously used for training purposes on this course. Ford is not aware of any other similar failures on any of the other subject or peer vehicles. Therefore, Ford believes this failure to be the result of an extreme usage and duty cycle unique to the Sacramento Police Department's pursuit training course and not a design or manufacturing defect.

This conclusion is supported by the very low number and corresponding rate of reports alleging any leakage, extended brake pedal travel or extended stopping distance related to the front brake jounce hose on the subject and peer vehicles.

Furthermore, Ford's testing has shown that the design of the brake system on the subject vehicles performs safely in the event of a front jounce hose failure. This, along with the very low number of reports (28) related to the front brake jounce hose (for any reason) on a population of more than 568,000 subject and peer vehicles, with overt indication of a low brake fluid condition as evidenced by customer verbatims, supports Ford's belief that there is no evidence demonstrating a defect in the design or construction of the subject brake hose.

Ford believes that consideration of all of these findings support a conclusion that there is no unreasonable risk to motor vehicle safety associated with this subject in these vehicles.

###