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February 29, 2008

Ms. Kathleen C. DeMeter, Director  
Office of Defects Investigation Safety Assurance  
National Highway Traffic Safety Administration  
1200 New Jersey Avenue, SE W45-302  
Washington, DC 20590

Dear Ms. DeMeter:

Subject: PE08-001:NVS—213kmb

The Ford Motor Company (Ford) response to the agency's January 11, 2008, letter concerning reports alleging lack of power brake assist in 2004 – 2006 model year F-150 vehicles is attached.

The power brake assist function in the subject vehicles with any of the three available engines is provided by a vacuum booster that is located between the brake pedal and the master cylinder and is mounted on the engine compartment side of the cowl. Power brake assist is generated by a pressure differential across the diaphragms within the booster and is transmitted to the master cylinder via a booster pushrod. Low pressure, generated by engine vacuum through the intake manifold, is located on the master cylinder side of the diaphragm. High pressure, provided by atmosphere, is located on the brake pedal side of the diaphragm. A check valve is incorporated on the booster end of the vacuum hose in order to maintain vacuum within the brake booster during low engine vacuum operating conditions and when the engine is turned off. This check valve also maintains vacuum reserve within the booster for a number of vehicle stops if the vacuum supply to the booster is interrupted, for example if there is a compromise to the vacuum hose. The vehicle's foundation brakes remain fully functional and are unaffected by loss of vacuum to the brake booster.

#### Report Reviews

A review of reports provided in this response found that the majority of complaints of the loss of power assist relate to vacuum hose detachment from the engine air intake manifold on 5.4L applications. In many of these reports, the customer notes some corresponding indication of vehicle malfunction prior to experiencing any loss of brake assist, such as a "popping" noise and/or a "puff of smoke underhood." Prior to experiencing any loss of brake assist, some customers also report hearing a "whistling" noise, presumably when the vacuum hose detaches from the intake manifold.



Should the vacuum hose become detached from the air intake system, engine performance will likely be affected and the engine's mass air flow sensor may detect an imbalance in the amount of air entering through the throttle body compared with the amount of air entering the intake. Diagnostic troubleshooting codes will be registered and will illuminate a check engine light due to a lean condition.

#### Vehicle Testing

Vehicle testing with the brake booster vacuum hose detached shows that the number of power assisted brake applications, for a given vehicle weight, is independent of vehicle speed. For example, a lightly loaded vehicle operating at 60 mph was found to have approximately four fully assisted brake applications during 0.25G (typical) decelerations before an increase in pedal efforts was recorded. A vehicle loaded to GVW was evaluated under the same conditions and found to have approximately three fully assisted brake applications.

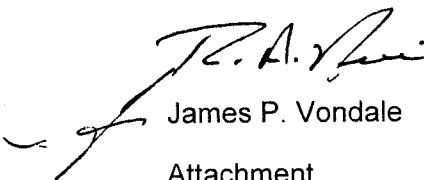
Ford notes that a number of customers mistakenly report a loss of brake function in the event the brake booster vacuum hose becomes detached from the fitting on the intake manifold, when in reality the customer still has full foundation brake function. Even though the vehicle may lose brake power assist after several brake applications, braking at a 0.25G deceleration requires approximately a 95 lbs force on the pedal to bring the vehicle to a complete stop, which is well within the capability of all drivers. The vehicle is controllable and the customer is able to bring it to a complete stop, with only an increase in brake pedal input force.

Between 2004 – 2006 model years, Ford produced over 1.6 million F-150 vehicles, of which, over 980,000 units were equipped with a 5.4L 3-Valve V-8 engine. With such a large vehicle population, it is not unexpected to have some number of accident allegations due to lack of power brake assist. Ford's review of warranty claims, field reports, and customer contacts identified only one report that alleges an F-150 contact with another vehicle while in traffic due to a lack of brake power assist resulting from a brake booster vacuum hose concern, and this incident reportedly occurred at very low speed. A few other reports allege vehicle contact with a stationary object, such as a garage door, gate, tree, or parked car, due to a lack of brake power assist attributable to the vacuum hose. Ford has not identified any injuries as a result of the alleged defect as of the date of this inquiry.

The loss of brake power assist due to vacuum loss does not present an unreasonable risk to motor vehicle safety. As is demonstrated by testing where power assist is intentionally compromised, the vehicle is capable of several power assisted stops and the vehicle's foundation braking system continues to function to bring the vehicle to a safe and controllable stop. This is supported by customer comments in the reports provided in this response and by the very few number of reports alleging minor vehicle contacts that are attributed to this condition across a large vehicle population.

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

Sincerely,



James P. Vondale

Attachment

FORD MOTOR COMPANY (FORD) RESPONSE TO PE08-001

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.

The agency has defined the subject vehicles to include the 2004-2006 model year F-150 vehicles. Ford notes that two F-150 vehicle platforms were produced during the 2004 model year, the PN-96 platform 2004 F-150 Heritage, and the P-221 platform F-150 that continued for the 2005 and 2006 model years. Ford has construed the agency's request to pertain to P-221 based F-150 vehicles.

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 January 11, 2008, the date of your inquiry. Ford has searched within the following offices for responsive documents: Ford Customer Service Division, Marketing and Sales Operations, Purchasing, Quality, Global Core Engineering, Office of the General Counsel, Vehicle Operations, North American Truck 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. Engine;
- 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 I, Data Collection Disc, for a pre-formatted table which 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 Virgin Islands) is 1,658,012.

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

Model	2004 MY	2005 MY	2006 MY
F-150	624,652	527,985	505,375

The requested data for each subject vehicle is provided electronically in Appendix A (filename: 2008-02-29 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 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 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), 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 Fleet Test Database, and the criteria used to search each of these are provided electronically in Appendix B (filename: 2008-02-29 Appendix B) on the enclosed CD.

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

Category	Allegation
A	Alleged loss of brake power assist due to the vacuum booster hose.
B	Alleged loss of brake power assist due to component other than the vacuum booster hose.
C	Alleged loss of brake power assist – non-specific cause.

We are providing electronic copies of reports categorized as "C" 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 Master Owner Relations System (MORS) database, as described in Appendix B, were reviewed for relevance and categorized in accordance with the categories described above. The number and copies of relevant owner reports identified in this search that may relate to the agency's investigation are provided in the MORS III portion of the electronic database contained in Appendix C (filename: 2008-02-29 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 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, Litigation Prevention. 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 Litigation Prevention section. Non-privileged documents for files that were located that are related to the responsive owner reports are provided electronically in Appendix D (filename: 2008-02-29 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 categorized in accordance with the categories described above. The number and copies of relevant field reports identified in this search that may relate to the agency's investigation 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 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 ten Vehicle Owner's Questionnaires (VOQs). Ford made inquiries of its MORS database for customer contacts, and its CQIS database for field reports concerning the vehicles identified 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. 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 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. A chart identifying potentially relevant allegations is being provided electronically as Appendix E (filename: 2008-02-29 Appendix E) on the enclosed CD. Copies of reports corresponding to these alleged incidents are provided in the MORS, CQIS, and Analytical Warranty System (AWS) portions of the electronic database provided in Appendix C.

Ford has identified one report that alleges a low speed (3 mph) F-150 contact with another vehicle while in traffic due to a lack of brake power assist resulting from a brake booster vacuum hose concern. Customers have alleged in nine reports of vehicle contact with a stationary object, such as a garage door, curb, tree, or parked car, due to a lack of power assist. One report alleges rear bumper damage due to a lack of brake power assist while the vehicle was being operated in reverse, but is not specific regarding what the vehicle contacted.

Ford has also identified one report, where a customer alleges vehicle contact due to a lack of brake power assist. The vehicle had been previously serviced for an engine concern where the intake manifold was removed. In the warranty repair following the incident, the customer noted brake lockup, no vacuum to brake booster, and check engine light concerns. Based on this information, it is Ford's assessment that the previous vehicle repair likely contributed to an intake leak that could have resulted in a lack of vacuum or reduced vacuum to the booster.

Claims, Lawsuits, and Arbitrations: For purposes of identifying incidents that may relate 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.

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

We are providing the requested detailed information, where available, on the responsive and ambiguous lawsuits and claims in our Log of Lawsuits and Claims, provided in Appendix C in the Legal Claim/Lawsuits tab on the enclosed CD. The number of relevant lawsuits and claims identified is also provided in this log. To the extent available, electronic copies of complaints, first notices, or copies of MORs reports relating to matters shown on the log are provided in Appendix F (filename: 2008-02-29 Appendix F) on the enclosed CD. 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. 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 1, Data Collection Disc, for a preformatted table which provides further details regarding this submission.

### Answer

Ford is providing owner and field reports in the electronic database contained in Appendix C on the enclosed CD 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 on the enclosed CD.

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.

Answer

Ford is providing owner and field reports in the electronic database contained in Appendix C on the enclosed CD in response to Request 2. Copies of complaints, first notices, or MORS reports relating to matters shown on the Log of Lawsuits and Claims provided in Appendix F in the Legal Claim/Lawsuits tab on the enclosed CD. 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 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; 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 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

Answer

Records identified in a search of the AWS database, as described in Appendix B, were reviewed for relevance and categorized in accordance with the categories described in the response to Request 2. The number and copies of relevant warranty claims identified in this search that may relate to the agency's investigation are provided in the AWS portion of the electronic database contained in Appendix C (filename: 2008-02-29 Appendix C) on the enclosed CD. 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 MORS 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.

#### 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 2004 – 2006 model year F-150 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. Optional Extended Service Plans (ESPs) were available to cover various vehicle systems, time in service and mileage increments. The details of the various plans are provided electronically in Appendix G (filename: 2008-02-29 Appendix G) on the enclosed CD.

#### 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 lack of power brake assist, 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 no SSMs and no TSBs that may relate to the alleged defect in the subject vehicles.

Internal Service Messages: Ford has identified one ISM that relates to loss of brake power assist or a lean condition due to a disconnected booster vacuum hose in the subject vehicles and is providing a copy in Appendix H (filename: 2008-02-29 Appendix H).

Field Review Committee: Ford has 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 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 I (filename: 2008-02-29 Appendix I).

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 as Appendix J (filename: 2008-02-29 Appendix J) with a request for confidentiality under separate cover to the agency's Office of the Chief Counsel pursuant to 49 CFR, Part 512.

In the interest of ensuring a timely and meaningful submission, Ford is not producing non-responsive materials or items containing little 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. Should the agency desire additional materials, Ford will cooperate with the request.

#### 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
- h. Whether the modified component can be interchanged with earlier production components.

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

#### Answer

A table of the requested changes is provided electronically as Appendix K (filename: 2008-02-29 Appendix K) on the enclosed CD. The three engines in 2004 through 2006 model year F-150 vehicles are: a 4.2L V-6, a 4.6L V-8, and a new to the 2004 MY F-150 5.4L 3-Valve V-8. Power assist for each configuration is provided to the brake booster by engine vacuum obtained from the intake manifold. The brake booster vacuum hose attaches to an integral fitting, which is unique to each engine and is located on the rear of each engine.

#### 4.2L V-6 Engine

The brake booster vacuum hose assembly for the 4.2L V-6 engine consists of a single rubber hose that connects to a fitting on the top of the intake manifold. A check valve fitting, located at the opposite end of the hose, provides a means of attachment to the brake booster and maintains vacuum in the booster during low engine vacuum operating conditions and when the engine is turned off.

#### 4.6L V-8 Engine

The brake booster vacuum hose assembly for the 4.6L V-8 engine is similar to the 4.2L V-6 engine and consists of a single rubber hose that connects to a fitting on the top of the intake manifold. A check valve fitting, located at the opposite end of the hose, provides a means of attachment to the brake booster and maintains vacuum in the booster during low engine vacuum operating conditions and when the engine is turned off.

#### 5.4L 3-Valve V-8 Engine

The brake booster vacuum hose assembly for the 5.4L 3-Valve V-8 engine utilizes a two piece assembly consisting of a stand pipe and vacuum hose. The stand pipe attaches to a fitting located at the bottom rear surface of the intake manifold utilizing a flexible rubber hose and plastic elbow and routes up along the rear of the intake manifold. The vacuum hose assembly attaches to the opposite end of the stand pipe. Like the other engines, a check valve fitting is located at the opposite end of the hose and provides a means of attachment to the brake booster and maintains vacuum in the booster during low engine vacuum operating conditions and when the engine is turned off.

#### Request 10

Produce one of each of the following:

- a. Exemplar samples of each design version of the subject component;
- b. Field return sample 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 is providing exemplar brake booster vacuum tube components for the 4.2L V-6 engine and 4.6L V-8 engine and a brake booster stand pipe and vacuum tube components for the 5.4L 3-Valve V-8 engine. Additionally, Ford is providing a field return stand pipe and vacuum tube from a 5.4L engine vehicle that was repaired due to a hard brake pedal complaint. No special kits have been released or developed by Ford for use in service repairs to the subject component or assembly that relates to the alleged defect in the subject vehicles.

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.

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 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 brake booster vacuum hoses by part number (both service and engineering) and year of sale, for each engine configuration, where available, in electronic form in Appendix L (filename: 2008-02-29 Appendix L) on the enclosed CD. Information pertaining to production and service usage for each part number, and supplier point of contact information, is also included in Appendix L. During its review of warranty claims, Ford notes that service technicians have occasionally used standard bulk vacuum hose, hose clamps, or cable ties to complete a brake booster vacuum tube repair. As a consequence, it is impossible to accurately estimate the number of such parts used for this specific repair.

Request 12

Provide the following information regarding the braking performance of the subject vehicles after a loss of vacuum assist:

- a. Provide a graph showing brake line hydraulic pressure as a function of pedal effort for (1) normal system operation and (2) with a complete loss of vacuum assist; and
- b. Provide a graph showing vehicle deceleration as a function of pedal effort for (1) normal system operation and (2) with a complete loss of vacuum assist.

Answer

Ford conducted vehicle tests using a 2005 model year F-150 SuperCrew equipped with a 5.4L engine to measure brake pedal force, brake booster vacuum, and brake line pressure for lightly loaded and GVW weight conditions both with and without brake power assist. Results of these tests are provided electronically in Appendix M (filename: 2008-02-29 Appendix M) on the enclosed CD.

Request 13

Furnish Ford's assessment of the alleged defect in the MY 2005 Ford F-150 vehicles equipped with 5.4L V-8 engines, 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 other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning;
- f. The reports included with this inquiry;
- g. A comparison of the frequencies of loss of brake assist complaints and warranty claims in the subject vehicles by model year and engine; and
- h. Ford's explanation of the reasons for any vehicles showing significantly higher complaint and/or warranty claim rates in the comparisons done in 13g.

Answer

The power brake assist function in the subject vehicles is provided by a vacuum booster that is located between the brake pedal and the master cylinder and is mounted on the engine compartment side of the cowl. Power brake assist is generated by a pressure differential across the diaphragms within the booster and is transmitted to the master cylinder via the booster pushrod. Low pressure, generated by engine vacuum through the intake manifold, is located on the master cylinder side of the diaphragm. High pressure, provided by atmosphere, is located on the brake pedal side of the diaphragm.

The vacuum developed in the engine intake manifold is transmitted to the booster on the subject vehicles by a single piece rubber hose for 4.2L V-6 and 4.6L V-8 engines and by a two piece stand pipe and rubber hose assembly for the 5.4L 3-Valve V8 engine. A check valve is incorporated on the booster end of the vacuum hose in order to maintain vacuum within the brake booster during low engine vacuum operating conditions and when the engine is turned off. This check valve will also maintain vacuum reserve within the booster for a number of vehicle stops if the vacuum supply to the booster is interrupted, for example if there is a compromise to the vacuum hose. The vehicle's foundation brakes remain fully functional and are unaffected by loss of vacuum to the brake booster.

Report Reviews

A review of reports provided in this response found that the majority of complaints of the loss of power assist relate to vacuum hose detachment from the engine air intake on 5.4L applications. In many of these reports, the customer notes some corresponding indication of vehicle malfunction prior to experiencing any loss of brake assist. For example, some customers report hearing a "popping" noise and/or observing a "puff of smoke underhood" prior to experiencing any loss of brake assist (AWS - VIN: 1FTPW12V46KC [REDACTED] FTPW12505FE [REDACTED] and 1FTPW12545KE [REDACTED]). Some customers also report hearing a "whistling" noise, presumably when the vacuum hose detaches from the intake manifold (AWS - VIN: 1FTRW12W34KA [REDACTED]).

Should the vacuum hose become detached from the air intake system, engine performance will likely be affected. The engine's mass air flow sensor may detect an imbalance in the amount of air entering through the throttle body compared with the amount of air entering the intake and

register diagnostic troubleshooting codes (DTCs) P0171 and P0174. These codes indicate a lean condition (AWS – VIN: 1FTPF12V86NE [REDACTED] and 1FTPW02546K [REDACTED]). As a consequence, the air/fuel ratio may be altered, and engine performance may be degraded. The customer may observe conditions such as a rough idle or difficulty starting, indicating that the vehicle is not performing as intended. In fact, Ford found many warranty claims that make no reference to undesirable brake performance, but nevertheless indicate that the vacuum hose was replaced to address engine performance complaints.

#### Vehicle Testing

During vehicle evaluations where brake pedal force and brake line pressure were recorded under various conditions, Ford also evaluated the number of power assisted stops drivers have available should the vacuum hose become detached from the air intake at both lower and higher deceleration rates for vehicles either lightly loaded or at gross vehicle weight.

Vehicle testing shows that the number of power assisted brake applications, for a given vehicle weight, is independent of vehicle speed. The number of power assisted stops decreases with higher deceleration rates and with increased vehicle weight. Brake pedal efforts may increase slightly as the vacuum in the booster is depleted with subsequent brake pedal applications. For example, a lightly loaded vehicle operating at 60 mph was found to have approximately four fully assisted brake applications during 0.25G decelerations before an increase in pedal efforts was recorded. A vehicle loaded to GVW was evaluated under the same conditions and found to have approximately three fully assisted brake applications.

Ford notes that a number of customers mistakenly report a loss of brake function in the event the brake booster vacuum hose becomes detached from the fitting on the intake manifold, when in reality the customer still has full foundation brake function. Ford also notes that the vast majority of brake applications in normal vehicle operation are in the 0.25G deceleration rate range, where testing has shown the driver should have between two and four brake applications with power assist before the vacuum reserve is depleted. Even though the vehicle may lose brake power assist after several brake applications, braking at a 0.25G deceleration requires approximately a 95 lbs force on the pedal to bring the vehicle to a complete stop, which is well within the capability of all drivers and is a result of the vehicle's foundation brake system remaining fully functional. The vehicle is controllable and the customer is able to bring it to a complete stop with an increase in brake pedal input force.

Between 2004 – 2006 model years, Ford produced over 1.6 million F-150 vehicles, of which, over 980,000 units were equipped with a 5.4L 3-Valve V-8 engine. With such a large vehicle population, it is not unexpected to have some number of accident allegations due to lack of power brake assist. Ford has reviewed warranty claims, field reports, and customer contacts and has identified one report that alleges a low speed F-150 contact with another vehicle while in traffic due to a lack of brake power assist resulting from a brake booster vacuum hose concern. The customer stated the speed was 3 mph at the time of the contact, which by any measure is a minor impact. Nine reports allege vehicle contact with a stationary object, such as a garage door, gate, tree, or parked car, due to a lack of brake power assist attributable to the vacuum hose. One reported event occurred while driving in reverse. One report, which alleges bumper damage, appears to be caused by an intake leak that could have resulted in a lack of vacuum or reduced vacuum to the booster. Additionally, Ford has not identified any injuries as a result of the alleged defect as of the date of this inquiry.

The loss of brake power assist due to vacuum loss does not represent an unreasonable risk to motor vehicle safety. As is demonstrated by testing where power assist is compromised, the vehicle is capable of several power assisted stops and the vehicle's foundation braking system

continues to function to bring the vehicle to a safe and controllable stop. This is supported by the customer comments in the reports provided in this response and by the very few number of minor contacts that are attributed to this condition across a large vehicle population.