

VOLVO

Volvo Cars of North America, LLC

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NVS-214

July 18, 2003

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OFFICE OF SAFETY INVESTIGATION

**Ms. Kathleen C. DeMeter, Director
Office of Defects Investigation
National Highway Traffic Safety Administration
Room 5326 (NSA-13.1)
400 Seventh Street, S.W.
Washington, D.C 20590**

**NVS-214 ags
EA02-026**

Dear Ms. DeMeter:

This letter, and its enclosures comprise the response of Volvo Cars of North America, LLC (VCNA) to your May 23, 2003 request, for information relating to Engineering Analysis EA02-026. In subsequent communication, your office granted an extension to the Volvo response until July 25, 2003 for questions # 1, 2, 8, 9 and 10, August 1, 2003 for questions # 5, 6 and 7 and August 11, 2003 for the remaining questions. We have managed to submit the answers to all questions on the original date July 18, 2003. Two copies are enclosed, as requested.

In order to respond to this request, Volvo undertook a thorough and diligent search. We spoke to a wide variety of affected persons, in the United States, Sweden and the Netherlands, who in the course of their daily business are responsible for the various items to the request. They, in good faith, conducted a thorough search for the information. Our response is based upon this diligent and thorough search.

During our research, Volvo reviewed all available documentation within its control, in order to answer NHTSA's questions pertaining to the subject vehicles and alleged incidents. We have in good faith, provided answers to these questions using the documentation that was available to us.

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

- a. Vehicle Identification Number (VIN)
- b. Make
- c. Model
- d. Model Year
- e. Date of Manufacture
- f. Date Warranty Coverage Commenced; and
- g. The State in the United States where the vehicle was originally sold or leased (or delivered for sale or lease)

Answer:

The numbers of subject vehicles sold in the United States are 35,395 for S/V40 MY 2000 and 35,272 for S/V40 MY 2001. A detailed listing of the subject vehicles retained are included as Attachment 1.

See Attachment 1 (File is only distributed in CD - R due to format and size. See summary below.)

Model	Model Year	Count
S40	2000	27,358
S40	2001	31,157
V40	2000	8,037
V40	2001	4,115

2. State the number of each of the following, received by Volvo, or of which Volvo 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

Answer:

Volvo has searched its customer contact database and has established a list of 62 possible brake vacuum pump-related inquiries, concerning 53 vehicles, where the customer alleged excessive brake pedal effort, hard pedal or extended stopping distance had occurred in the subject vehicles. The number of inquiries are distributed per calendar year: In 2000 6 inquiries, 2001 17 inquiries, 2002 30 inquiries, and 2003 up to now 9

inquiries . This indicates the trend is now going down. Copies of those inquiries are submitted as Attachment 2 (CD-R). Please notice that a significant number of cases submitted in response to this question are also included in the responses to Questions 2b, 2c and 8.

- b. Field reports, including dealer field reports

Answer:

Volvo has found 33 Technical Reports (21 reported previously in PE02-009 + 12 new reports) related to 32 vehicles. We have no Technical Reports since October 2002. This clearly shows trend is going down. Copies of those items are submitted as Attachment 3 (CD-R). A significant number of cases submitted in response to this question are also included in the responses to Questions 2b, 2c and 8.

See Attachment 3 for further details.

- 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.

Answer:

Volvo has 22 very minor incident reports (21 reported previously in meeting in Washington, D.C on January 24, 2003), with no reported injuries, and these VIN(s) are listed in Attachment 4 (CD-R). Clearly, this shows the trend is decreasing. Questions 2a, 2b and 2c separately refer to 62 consumer complaints, 33 field reports, and 22 minor incident reports. A significant number of cases submitted in response to this question are also included in the responses to Questions 2b, 2c and 8. When studying these 22 reports, our conclusion is, in a majority of the incidents reported there is a high involvement of driver and environmental effects.

- d. Property damage claims

Answer:

Volvo has had no property damage claims, which relate to the alleged defect conditions in the subject vehicles.

- e. Third-party arbitration proceedings where manufacturer short name is or was a party to the arbitration, and

Answer:

Volvo has had no third-party arbitration proceedings, which relate to the alleged defect conditions in the subject vehicles.

- f. Lawsuits both pending and closed, in which Volvo is or was defendant or codefendant.

Answer:

Volvo has found four (4) lawsuits. Three were "Lemon Law" cases and one brake wear related case. All cases included alleged brake related conditions that could relate to the alleged defect conditions in the subject vehicles. Neither case involved an incident or personal injury. A summary of the four (4) lawsuits is included.

[REDACTED]
MY 2000; V40
Chassis # 515429
El Paso County, Colorado
Court Case # 03CV0154-Division 15
Case Settled: January 29, 2003

[REDACTED]
MY 2001; S40
VIN: YV1VS29581 [REDACTED]
Chassis # 660404
New Jersey Lemon Law Filing
Court Case # Not Available
Case Settled: Not Available

[REDACTED]
MY 2000; V40
Chassis # 426954
VIN: YV1VW252XY [REDACTED]
Court of Common Pleas Philadelphia County
Court Case/Docket # 001270
Case Settled: March 2002

[REDACTED]
MY 2000; S40
Chassis # 566001
VIN: YV1VS2559YF [REDACTED]
State of Michigan Circuit Court for the County of Oakland
Court Case # Not Available
Case Settled: April 2002

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. Volvo'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 THREE DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer:

All information provided in attachment # 5 (CD-R)

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 Volvo used for organizing the documents. As indicated earlier, for any document provided to ODI in your May 2, 2002 and March 12, 2003 submissions, Volvo may either produce it again or identify the document, the document submission to ODI in which it was included and the precise location in that submission where the document is located.

Answer:

All information provided in attachment # 6 (CD-R)

5. Other than the subject vehicles, are there any 1999 through 2003 MY vehicles manufactured by Volvo for sale or lease in the United States that are equipped with an auxiliary brake power-assist vacuum system? If so, state the make, model and model year of those vehicles.

Answer:

The following vehicles are equipped with an auxiliary brake power-assist vacuum system in addition to the vacuum created of the engine, for customer comfort and improved pedal feel.

- Volvo S80 from MY 2002 and onwards
- Volvo S60 from MY 2003 and onwards
- Volvo V70 and XC 70 from MY 2003 and onwards
- Volvo XC 90 from MY 2003 and onwards

6. Are any of the vehicles identified by the make(s), model(s) and model year(s) included in your response to Request No. 5 equipped with an auxiliary brake power-assist vacuum system that is the same, or substantially the same, as that used on the subject vehicles? If so, state the make, model and model year of those vehicles. For the purposes of this Request, the major factors to be considered in determining the similarities between the auxiliary brake power-assist vacuum systems used on different make, model and model year vehicles are the basic design of the auxiliary brake power-assist vacuum system, the design, function, and location of the brake vacuum pump, and the location, routing, and materials of the various lines, tubes, hoses, fittings, valves, and connectors of the vehicle's brake power-assist vacuum system.

Answer:

For all the vehicles mentioned in question # 5, the vacuum pump and the pressure switch that operates the pump is of the same type as in the X 40 from MY 2001 (Hella pump type). Please notice that they are located in a different part of the engine compartment.

7. For each of the vehicles identified by the make(s), model(s) and model year(s) included in your response to Request No. 5 that are not included in your response to Request No. 6, describe the differences between the brake power-assist vacuum system on such vehicles and the brake power-assist vacuum system used on the subject vehicles. For the purposes of this Request, the major factors to be considered in describing the differences between the auxiliary brake power-assist vacuum systems used on different make, model and model year vehicles are the basic design of the auxiliary brake power-assist vacuum system, the design, function, and location of the brake vacuum pump, the location of the brake vacuum pump, and the location, routing, and materials of the various lines, tubes, hoses, fittings, valves, and connectors of the vehicle's brake power-assist vacuum system.

Answer:

Not applicable, for other vehicles the engine is the only source of vacuum.

8. State, by model and model year, a total count for all of the following categories of claims, collectively, that have been paid by Volvo 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. Volvo'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. Replacement part number(s) and description(s);
- i. Concern stated by customer; and
- j. 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 that provides further details regarding this submission

Answer:

As of July 10, 2003, 1885 warranty claims for MY 00 and 552 warranty claims for MY 01 have been received by Volvo that could relate to the alleged defect in the subject vehicles (see Attachment 7 CD-R). In addition, there were 2000 brake vacuum pumps repaired using labor operation 05260-6 referenced in Tech Net Note 52-01. Please notice in some cases the information was not provided by customer and/or car owner. Therefore, our system does not have such information.

9. Describe in detail the search criteria used by Volvo to identify the claims identified in response to Request No. 8, 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 Volvo on the subject vehicles (i.e., the number of months and mileage for which converge is provided and the vehicle systems that are covered). Describe any extended warranty coverage option(s) related to the alleged defect that Volvo offered for the subject vehicles and state by option, model, and model year, the number of vehicles that are covered under each such extended warranty.

Answer:

The new vehicle warranty coverage for MY 2000 and 2001, is 4 years or 50,000 miles. No extended warranty coverage is applicable for the vehicles in question. We used our warranty data system and the search was done for the following Operations code used when Volvo Engineers studied these items are as follows:

- **52602 Pump Remove Install Replace**
- **05260-6 Clean Pump Apply Sealant**

Please notice the total counts includes all system codes below, therefore when operation code 52602 is used by the workshop it does not necessarily correspond to reduced or affected braking performance of the vehicle. As you can see the repairs is significantly reduced for MY 2001.

The following Symptoms Codes Volvo Engineers found when studying this item are as follows:

- 1A = Noise**
- 3B = Vibrates**
- 4C = Moisture**
- 4D = Worn**
- 4E = Broken**
- 4F = Deformed**
- 5B = Stiff, Hard**
- 5C = Light, Soft**
- 5D = Loose**
- 5E = Leakage**
- 5F = Blocked**
- 5G = Faulty indication**
- 5H = Warning lamp lit**
- 5M = Poor drive-ability**
- 5N = Difficult to start**
- 5O = Falls to stop**
- 5P = Low power / reduced function**
- 5Q = Intermittent function**
- 5S = No function**
- 6A = Inspection required**

10. Produce copies of all service, warranty, and other documents that relate to, or may relate to, the alleged defect in the subject vehicles, that Volvo 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 manufacturer's short name is planning to issue within the next 120 days.

Answer:

Attached you find a copy of the tech net note 52-01. Attachment # 8 (CD-R)

11. 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, Volvo. 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.

Also, provide the above information for any modification or change of which Volvo is aware that may be incorporated into vehicle production within the next 120 days or into 2004 MY Volvo S40 and V40 vehicles.

Answer:

Volvo is continuously testing and investigating a variety of issues that come to our attention as a part of our daily quality improvement process. In this case the following analyses were done,

Analyze #1,

- a) Electrical Brake vacuum pump MY-00 & water entrance / freezing
- b) 02-09-2000
- c) 02-11-2000
- d) Establish root cause of no function of the Pierburg pump freezing over night at production site Born in The Netherlands.
- e) Quality engineering team chassis at Born site.
- f) Root cause established to be water coming in to the top of the pump. Pump seized and fuse blown. Action suggested introduces rust proof sealant in factory and release tech net note 52-01 for produced cars.

Analyze #2,

- a) Electrical Brake vacuum pump MY-01, not working
- b) 10-12-2000
- c) 08-11-2001
- d) Establish root cause of no function of the Hella pump and why the fuse sometimes is blown.
- e) Quality engineering team chassis at Born site.
- f) Root cause established to be water entering pump air outlet when engine is shut of caused by de-pressures in the pump. Temporary solution, adding tape on the air outlet introduced from week 18 (May 2001). The Final solution was introduced with part number 30630398.

Analyze #3,

- a) Electrical Brake vacuum pump MY-00 relay failure
- b) 12-14-2000
- c) 08-30-2001
- d) Establish root cause of no function or continuous running of the Pierburg pump.
- e) Quality engineering team chassis at Born site.
- f) Root cause established to be broken clips holding the relay. Relay out of position exposed for water entrance via connectors. This was established when solution was out of series production. No action was needed because of a very few cases.

Analyze #4,

- a) Electrical Brake vacuum pump MY-00 installation problem.
- b) 06-21-2002
- c) 04-02-2003
- d) Investigation of corroded steel pipe found in the Pierburg pump.
- e) Quality engineering team chassis at Born site.
- f) Root cause established to be water from the vacuum pump as known from previous investigation. Pump and steel pipe was out of function. Very few cases known of further penetration of water for other parts in the system found. Main problem already fixed with sealing of the pump no action needed.

12. Describe all modifications or changes made by, or on behalf of, Volvo in the design, material composition, manufacture, quality control, supply, or installation of the subject component, which relate to, or may relate to, the alleged defect in the subject vehicles from the start of production of the subject vehicles through the 2003 MY for Volvo S40 and V40 vehicles manufactured by Volvo for sale or

lease in the United States. 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 of which Volvo is aware that may be incorporated into vehicles production within the next 120 days or into 2004 MY Volvo S40 and V40 vehicles.

Answer:

The modifications or changes to the auxiliary vacuum systems for MY 2000 and MY 2001 in relation to the alleged defect found by Volvo engineers are as presented below in chronological order.

Note:

- MY 2000 was produced from end of April (week 18) year 1999 up to end of April (week 19) year 2000.
- MY 2001 was produced from May week 20 year 2000 up to end of August (week 34) 2001.
- MY 2002 started September (week 35) 2001.
- MY 2003 started May (week 19) 2002.

#1

- a) Supplier based introduction March (week 14) in 2000, temporary factory based introduction February (week 05).
- b) Due to frozen vacuum pumps on the production site a sealer is added to seal the Pierburg pump from water entry.
- c) Action related to a production request.
- d) 30884459
- e) 30884459 number was kept.
- f) The original unmodified components are withdrawn from production in February (week 05) and not withdrawn from sale (Tech-Net Note 52-01 issued)
- g) The modified component was made not available as a service component.
- h) The modified component is interchangeable with the earlier production components.

#2

- a) Introduction of MY 2001.
- b) The pump unit consisting of a Pierburg pump including all connections to the engine, the brake system and the electrical system are modified into a pump unit consisting of a Hella pump including all connections to the engine, the brake system and the electrical system.
- c) The change was made for noise reduction. When the Pierburg pump runs it makes a clear noticeable noise. For reason of a packaging change in the engine bay there was a possibility to build the smaller Hella pump in the car in the engine bay.
- d) See information provided with question # 13.
- e) See information provided with question # 13.
- f) The original unmodified components are withdrawn from production ended for MY 2000.
- g) The modified component was made available as a service component from MY 2001.
- h) The modified component is not interchangeable with the earlier production components.

#3

- a) Introduction date April (week 18) 2001
- b) Tape added to vacuum pump. Taps is added to the back of the pump, from flange down to motor housing. This is to guide water away from the vacuum pump air outlet.
- c) A temporary solution to solve a problem for the customers.

- d) 30616992
- e) No modified part number given.
- f) The original unmodified components are withdrawn from production in April 2001 and withdrawn from sale after stock. Time not available due to not modified part number.
- g) The modified component was not made available as a service component.
- h) The modified component is interchangeable with the earlier production components.

#4

- a) Introduction date mid October (week 43) 2001.
- b) The vacuum pump housing is modified so it can carry a protection to avoid water entrance. The protection is included in the pump article number.
- c) Change made to simplify assembly at Hella. Tape was replaced by rubber.
- d) 30616992 (30630373 Delivery Unit)
- e) 30630398 (30638450 Delivery Unit)
- f) The original unmodified components are withdrawn from production in mid October 2001 and withdrawn from sale August 2002
- g) The modified component was made available as a service component since October 2001
- h) The modified component is interchangeable with the earlier production components.

13. Produce one of each of the following:

- a. Exemplar example of the original design version of the subject component; and
- b. Any kits that have been released, or developed, by Volvo for use in service repairs to the subject component/assembly which relate, or may relate, the alleged defect in the subject vehicles.

Answer:

- a. Two demos will be provided. One Pierburg demo and one Hella demo. In attachment # 9 Pictures added from Vadis system (Volvo System) to describe/address part no. vs. part. (CD-R)
- b. No kit was released.

14. State the number of each of the following that Volvo 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. Brake vacuum pump;
- b. "T-fitting" that connects the brake vacuum pump to the brake power-assist vacuum system (this fitting is mentioned in Volvo's Tech Net Note 52-01);
- c. any other lines, tubes hoses, fittings, valves, and connectors of the vehicle's brake Deterioration/degradation, either directly or indirectly, that result from the intrusion of Water into the vehicle's brake power-assist vacuum system; and
- d. Any kits that have been released, or developed, by Volvo for use in service repairs to the subject component/assembly.

Answer:

Vacuum pump with mounting components (MY 2000)

30884466	Pipe	Supplier:	Dana Unit12, junction six Industrial Park Witton Birmingham B167JJ Great Britain	Sales: D Taylor 44-121325814
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30884310 (Only Temp Part #) (For Service. (Current # 30884467)	Hose	Supplier:	TI Automotive (Bundy) Schoebroekstraat 20 3583 Paal Beringen Belgium	Sales: E Pollaris 32-1145643
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30884459 (Delivery unit to production)	Pump	Supplier:	Inalfa Maasheeseweg 83 5800 AA Venray The Netherlands	Sales: R Jaeken 32-11440327
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Content of 30884459 can be used as spare parts:

-30884444	Pump	Supplier:	Pierburg AG
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D41456 Neuss
Germany

-30884457 Switch Supplier: TRW Fahrzeugelektrik GmbH & Co
D78304 Radolfzell
Germany

-30630442 Clip Supplier: PB Electrovertrieb GmbH
D64823 Gross Umstadt
Germany

-1323592 Relay Supplier: Alcoa Fujikura GmbH
D72609 Nürtingen
Germany

-30865348 T-Piece Supplier: Rasmussen GmbH
D63641 Malital
Germany

Vacuum pump with mounting components (MY 2001)

30616993 Hose Supplier: TI Automotive (Bundy)
(CH# -685753) Schoebroekstraat 20
3583 Paal Beringen
Belgium

Sales: E Pollaris
32-1145643

30620958 Hose Supplier: TI Automotive (Bundy)
(CH# 685754 -) Schoebroekstraat 20
3583 Paal Beringen
Belgium

Sales: E Pollaris
32-1145643

30616990, 30630373 Pump Supplier: Inalfa
Delivery Unit to production Maashoeweg 83
(MY 2001-) 5800 AA Venray
The Netherlands

Sales: R Jaeken
32-11440327

Content of 30616990, 30630373 used as spare part:

-30616992 Pump Supplier: Hella KG Hneck & Co
Rixbecker Strasse 75
59552 Lippstadt
Germany

30638450 Pump Supplier:
Delivery Unit to production

Inalfa
Maasbeeseweg 83
5800 AA Venray
The Netherlands

Sales:

R Jaeken
32-11440327

Content of 30638450 used as spare part:
30630398 Pump Supplier:

Hella KG Hueck & Co
Rixbecker Strasse 75
59552 Lippstadt
Germany

Note:

Attached are the spare part sales from VCNA to the dealers for the parts in question described in Question # 12. It should be noted that we do not keep a record for where the sold part is used. We only keep record of part sales. The relay is a common part used in many different applications of all Volvo vehicles; therefore the sales figures do not reflect the application of this part of the vacuum pump.

Parts Sales						
Part Number	1999	2000	2001	2002	2003 up to 6/30	Description
30884486	0	28	25	27	31	Pipe
30884310	0	36	65	2	0	Hose
30884487	0	0	30	145	104	Hose (prod. # for 30884310)
30884488	0	114	407	542	538	Pierburg pump kit
30884444	3	108	287	410	5	Pierburg pump
30884467	5	83	147	143	42	Switch
30630442	0	0	0	10	8	Clip
1323592	9427	8354	7779	8789	1937	Relay
30865358	2	194	358	311	85	T-fitting
30616993	0	10	81	49	12	Hose
30820958	0	0	15	51	28	Hose
30616992	0	35	404	156	0	Hella pump
30630398	0	0	3	121	179	Hella pump used in other vehicles see answer question #6

15. In its response to the PEIR, Volvo characterized the main issue of this investigation to be the failure of the brake vacuum pump to operate, due to water intrusion into the pump, resulting in a reduced level of available brake power-assist during cold start conditions, and implied that this issue was resolved for vehicles manufactured after January 2000 by a modification to the pump and for

vehicles manufactured prior to this time by Tech Net Note 52-01. However, ODI has become aware of several other concerns related to the vehicle's brake power-assist vacuum system after reviewing the information gathered to date.

These are:

- a. The failure of brake vacuum pumps on vehicles manufactured after January 2000 and the failure of brake vacuum pumps after their being repaired per Tech Net Note 52-01;
- b. The intrusion of sufficient water into the brake power-assist vacuum system to result in the build-up of water and rust in hoses and/or pipes in that system that in several cases necessitated the replacement of the brake booster, the metal pipe that leads to the brake booster an/or the check valve(s);
- c. The leakage of battery acid into the brake vacuum pump and associated lines, tubes, hoses, fittings, valves, and/or connectors resulting in leaks in the brake power-assist vacuum system.

Separately for each of these concerns, furnish Volvo's assessment of each as they relate to the alleged defect in the subject vehicle, including:

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that is poses;
- e. The reports included with this inquiry.

Answer:

a. When Volvo Car Corporation (VCC) Engineering became aware of the issue with the auxiliary vacuum pump due to water entrance a counter measure was taken to overcome the direct pump issues. At that time, the only knowledge to VCC engineers was the experience out of the factory. The factory reported over night that a number of pumps were frozen, due to storage of the vehicles by reported temperatures below zero degrees Celsius.

After further investigation, it was found out that there was water in the pump due to the shower operation in the factory of Born in the Netherlands (water test in the factory). The water in the pump never caused a problem at the factory site before and we have not received any reports from the market stating any signals about the mentioned problem. Sealing the pump top portion prevented the water entrance in

the pump. This operation was implemented in production from February year 2000.

Shortly after MY 01 production started, problems occurred also in some cases from customers of MY 2000 vehicles and that lead to a further improvement of the Hella pump that was released for production April year 2001. VCC deeply believe this is a comfort issue as described in earlier sent graphs/measurement taken from vehicles in question.

b. When the pump complaints started it was not known at VCC engineering that when water had entered the pump also water could affect the pipe connecting the pump. In addition, the main vacuum supply VCC engineering did not know of any reported case(s) showing that the pressure switch could fail due to a broken hose connection (leak) or a blockade internally (due to corrosion). These issues were never found in the development phase in the factory. However, our investigation did find failure of the pressure switch. When the pressure switch fails, the pump tries to compensate by running continuously. This nonstop operation of the pump causes the pump to stop working. As stated in analyze # 4 in question # 11a very minor number of cases known by VCC. Even if this should occur, it falls under the same failure effect as when the pump is not working.

c. VCC engineering was not aware that there could be a high temperature effect on the battery, causing battery acid leakage. During this investigation, we have seen a very minor number of reports describing the problem. They are all related to MY 2000.

This is to our knowledge not a common issue, it only occurs in a few isolated cases. Even if this should occur it falls under the same failure effect as when the pump is not working. According to our understanding, the driver in a case like this would be alerted by the noise of the pump, since it would run when the engine is shut off.

Conclusion:

The 70,000 subject vehicles have gone approximately 300 million miles without even one single minor injury. We assumed approximately 14,000 miles/year of travel. This clearly shows that there is not a safety-related issue with the S and V 40 vehicles auxiliary brake vacuum pump system.

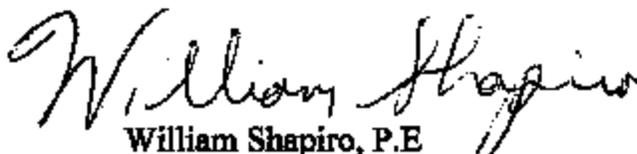
The vacuum pump in the brake system is designed to operate for an extremely short amount of time in cold start operation. In many cases that we have read and analyzed in this investigation, we have noticed and observed the owner gets a clear warning through the brake system when this pump does not operate properly. The driver had a different pedal feel. This is also supported by the graphs earlier presented to you about how the pedal efforts are affected by the vacuum levels. Please see attachment # 10 and 11 (CD-R). By the same token, the trend of the number of APFs, customer inquires and tech reports about this issue have shown a very clear trend downwards.

During the process of further investigating other manufacturers alleged brake system problems, we encountered a substantially similar NHTSA Engineering Analysis case regarding General Motors. Please reference EA 01-013 regarding vacuum assisted brakes for G M vehicles. The report states a failure in the booster which affects the braking performance and pedal effort for the driver. However, the investigation was closed after NHTSA felt that it was not a safety-related defect trend in the case.

As a result, based on the above facts, Volvo deeply believes that our S40 and V 40 alleged brake vacuum pump failure is not an unreasonable risk to motor vehicle safety. We feel this investigation should be closed upon review. We strongly believe this is not a safety-related defect. As we have proven in our analysis, the auxiliary vacuum pump is a comfort item for the driver.

We would like to meet with you and your staff at your convenience to discuss this matter further by mid August 2003. If there are further questions about this matter, please let me know.

Sincerely yours,



William Shapiro, P.E
Volvo Cars of North America, LLC
Manager, Regulation and Compliance Department.