



SALES DIVISION
6400 KATELLA AVENUE
CYPRESS, CALIFORNIA 90630-6208
(714) 372-6000
TELEFAX (714) 373-1020
mitsubishicars.com

MAILING ADDRESS:
P.O. BOX 6400
CYPRESS, CALIFORNIA 90630 0064

August 23, 2006

Mr. Jeffrey L. Quandt, Chief
Vehicle Control Division
NHTSA Office of Defects Investigation

RE: NVS-213-aan, RQ-06-007

Dear Mr. Quandt:

Mitsubishi submits the remaining information in response to Recall Query RQ-06-007 for Questions 8, 9, 10, 13 and 14. The attached Document List summarizes the information and documentation provided in this response. Responses to Questions 1 through 7, 11, and 12 were provided on July 28, 2006.

Mitsubishi feels that the information in response to these questions is confidential commercial material. In accordance with 49 CFR Part 512, two copies of this information and documentation, with the appropriate confidentiality requests and their supporting information, have been submitted to the Office of Chief Counsel (NCC-113), National Highway Traffic Safety Administration, Room 5219, 400 Seventh Street S.W., Washington, DC 20590.

Should you have any questions or need additional information, you can reach me at one of the contact points listed below.

Sincerely,

A handwritten signature in black ink, appearing to read "Kent Reeves", written over a horizontal line.

Kent Reeves, National Manager
Product Support & Technical Compliance
Phone: 714-372-6362
Fax: 714-934-4242
Email: kreeves@mmsa.com



- Q.8. Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and 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, Mitsubishi. For each such action, provide the following information:
- Action title or identifier
 - Actual or planned start date
 - Actual or expected end date
 - Brief summary of the subject and objective of the action
 - Engineering group(s)/supplier(s) responsible for designing and or conducting the action
 - 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.

- A.8. Responsive information with respect to each action is provided in Documents No. 2 through 14, No. 16 through 23, and No. 32. A one-page summary is included describing a. through f. and related documentation for each action, the Japanese originals and their respective English translations.**

- Q.9. Provide a table summarizing all testing conducted by, or for, Mitsubishi to assess the performance of the brake system in the subject vehicles in the normal condition and in any and all "backup" conditions (e.g., loss of brake power assist, partial system failure). The following information is included in the table: (1) test number; (2) test date; (3) test vehicle description; (4) test description/configuration; and (5) the brake pedal effort, brake pedal travel, maximum deceleration, and stopping distance for each test run. Include in this response all materials related to compliance testing/certification for Federal Motor Vehicle Safety Standard No. 135 S7.11, "Passenger Car Brake Systems/Brake Power Unit or Brake Power Assist Unit Inoperative (Depleted)." Provide copies of all test reports.

- A.9. Document No. 24 contains a table summarizing all testing conducted by Mitsubishi to assess the performance of the brake system.**

Test results including the applicable data are provided in Documents No. 1 and No. 15.

- Q.10. Describe all modifications and changes made by, or on behalf of, Mitsubishi 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 in the subject vehicles. For each modification/change, provide the following information:
- The date or approximate date on which the modification or change was incorporated into vehicle production
 - A detailed description of the modification or change
 - The reason(s) for the modification or change
 - The part numbers (service and engineering) of the original component
 - The part numbers (service and engineering) of the modified component
 - Whether the original unmodified component was withdrawn from production and/or sale, and if so, when
 - When the modified component was made available as a service component
 - Whether the modified component can be interchanged with earlier production components.

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

- A.10. Document No. 25 contains a table summarizing all modifications and changes, including design, manufacture, and quality control, which relate to the accumulator of the subject vehicles. Cross-sectional drawings explaining the differences between the original and modified parts for the accumulator are also included.**

- Q.13. Describe (and represent graphically) the amount of boost gain provided by the hydraulic brake booster assembly, measured in terms of hydraulic brake line pressure as a function of the force applied to the brake pedal by the driver, when the hydraulic brake booster assembly is both normally functioning and inoperative/depleted. Also describe (and represent graphically) the relationship between brake pedal travel and the force applied to the brake pedal by the driver when the hydraulic brake booster assembly is both normally functioning and inoperative/depleted. In addition, state the following information:
- Brake pedal lever ratio
 - Maximum achievable brake pedal height
 - Maximum achievable range of brake pedal free play
 - Minimum achievable pedal reserve distance for a normally functioning brake system
- A.13. Document No. 26 is responsive to Question 13 and has a written and graphical description of the amount of boost gain provided by the hydraulic brake booster assembly when the hydraulic brake booster assembly is both normally functioning and inoperative/depleted as well as a written and graphical description of the relationship between brake pedal travel and the force applied to the brake pedal by the driver when the hydraulic brake booster assembly is both normally functioning and inoperative/depleted.
- Q.14. Furnish Mitsubishi's assessment of the alleged defect in the subject vehicle, including:
- Causal/contributory factor(s)
 - Failure mechanism(s)
 - Failure mode(s)
 - Risk to motor vehicle safety that the failure poses
 - 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;
 - The reports included with this inquiry.
- A.14. Mitsubishi's assessment of the HBB accumulator defect in the subject vehicle is as follows:
- Factors**
The HBB is a system comprised of a regular master cylinder for front brake and the compressed pressure maintained in the accumulator is utilized to provide assist force to front brake line and brake force to rear brake line. Refer to Document No. 27 Attachment 1. However, due to diaphragm damage in the accumulator, the following phenomena may occur: noise, insufficient brake assist right after start, and assist delay when actuating the brake at high G. The diaphragm damage mechanism and the occurrence phenomena are described in detail in b. and c below.
 - Failure mechanism(s)**
 - Previous Recall Implementation (launched in October 2001)**
Fatigue failure occurs as a result of the following factors:
 - An abnormal increase in die temperature when vulcanizing the diaphragm and abnormal removal of the die (additional force when removing die) causes internal resin film damage which leads to fatigue failure.
 - Due to misalignment during diaphragm assembly, localized stress focused on the internal resin film leads to fatigue failure.
 - Poor temperature management when forming the resin film results in uneven film thickness causing localized stress focused on the internal resin film leading to fatigue failure.
 - Incidence of Occurrence after Countermeasures of Previous Recall**
When the recall was launched, accumulator production was increased (during production period July 2001 through November 2001), and new inexperienced operators assembled the top and bottom of the diaphragm such that they interfered with each other, causing damage (initial cracking) to the film resin inside the diaphragm. This damage leads to further

cracking in-use, resulting in complete diaphragm damage (through cracking). Refer to Document No. 28 Attachment 2.

c. Failure mode(s)

Although the diaphragm damage mechanism fundamentally differs from the recall, the phenomena caused by the diaphragm damage are essentially the same as those at the time of the recall as shown in below (1) to (3). Although item (1) Noise is a primary phenomenon, under limited conditions, items (2) and (3) may also occur. For details, refer to Document No. 29 Attachment 3.

- (1) Noise
- (2) Assist insufficient right after start (3 - 8.5 seconds)
- (3) Assist delay when actuating brake at high G (above 0.6G)

d. Risk to motor vehicle safety

- The occurrence phenomenon described in c. (1) Noise is not a safety-related issue.
- Item (2) Assist insufficient right after start (3 - 8.5 seconds) is a phenomenon occurring under very limited conditions and the fundamental safety risk is substantially low.
- Item (3) Assist delay when actuating brake at high G (above 0.6G) is a time delay of 0.2 to 0.3 seconds and the fundamental safety risk associated with this phenomena is also low.
- Although some customer complaints refer to an accident, we believe those claims are not related to the accumulator diaphragm damage considering the alleged phenomena described in the claims.
- Regarding the above, our opinion with respect to safety-related risk has not been changed since the last recall was launched.

Since the problem in the previous recall was fundamentally caused by the accumulator manufacturing process having a strong tendency for forming resin film with uneven thickness and misaligning the diaphragm, a high occurrence rate was expected in the future.

Accordingly, the decision was made to implement a recall to replace the accumulator with a modified one. In comparison to the last recall, the cause of the problem after the countermeasures was incidental human error committed by inexperienced temporary workers and the estimated future occurrence is substantially lower as shown in the table below Refer to Document No. 30 Attachment 4. Since the safety risk is substantially low as mentioned above (refer to Document No. 29 attachment 3), and customers can easily recognize the condition due to abnormal noise, we believe an improvement measure by recall is unnecessary.

Results from Warranty Data Analysis (%)

Estimation Point	F(12)	F(24)	F(36)	F(48)	F(60)
Before Countermeasures (Recall)	0.6	36.5	99.6	100	100
After Countermeasures	0.43	0.50	0.83	1.27	1.73

e. Whether the Driver or Persons Outside the Vehicle would be Warned if the Relevant Part were to Fail

When the accumulator is damaged and the brake pedal actuated, the noise in c. (1) occurs every time and the driver should easily notice something wrong with the brakes.

f. Opinion regarding Reports (6 claims from ODI) Included in this Query

The conceivable phenomena due to diaphragm damage in the subject accumulator are noise occurring when the brake pedal is actuated, insufficient brake assist right after engine start, and assist delay when actuating the brake at high G.

We cannot specify the cause of the problem in the six ODI claims since we have not inspected the vehicles or parts. However, based on the alleged phenomena mentioned in the customer claims, four out of the six claims appear to be related to accumulator diaphragm damage while the two other claims, including one accident, are not related to accumulator diaphragm damage. Refer to Document No. 31 attachment 5.

Document List

* : M = Meeting Minutes; R = Test Report; D = Document

No.	Type *	Document Date	Created by	Title	Summary of Content
1	R	11/25/1999	MMC	General Performance Confirmation Test Results for US CK with HBB. Response to Question 9.	When developing the CK(Montero) brake for the US market, brake performance was evaluated based on FMVSS 135. The results show compliance with the relevant standard.
2	M	11/9/2000	MMC	November 2000 Quality Meeting Minutes. Response to Question 8.	These are the results of discussions regarding the HBB accumulator diaphragm damage issue as raised up to the Quality Meeting (new item)
3	R	4/16/2001	Aisin Seiki	Pajero HBB Accumulator -Pressure Characteristics of Returned Parts. Response to Question 8.	The pressure characteristics of accumulators returned from the market as well as leakage and pressure characteristics from full accumulation over an extended period of time (45-day period) were investigated.
4	M	4/18/2001	MMC	April 2001 Quality Meeting Minutes. Response to Question 8.	This document contains the results of the on-going discussions at the Quality Meeting. The cause of diaphragm damage and details of the countermeasures are summarized.
5	M	4/27/2001	MMC	April 2001 Ad-hoc Quality Meeting Minutes. Response to Question 8.	These are the minutes of the on-going discussions at the April 2001 Ad-hoc Quality Meeting. Insufficient brake effectiveness in-use was not confirmed by bench testing.
6	M	5/16/2001	MMC	May 2001 Ad-hoc Quality Meeting Minutes. Response to Question 8.	These are the minutes for the on-going discussions at the May 2001 Ad-hoc Quality Meeting. Results of the investigation into the cause mechanism, the replacement procedure for the accumulator itself, among others, are described.
7	R	5/23/2001	Aisin Seiki	Pajero HBB Accumulator -Improved diaphragm-type ACC Investigation- -Evaluation Status from May 15. Response to Question 8.	The failure mechanism was inferred from the parts returned and, taking into account the clarified ACC improvement, the improvement details and its effectiveness were confirmed from the test assessment.

No.	Type *	Document Date	Created by	Title	Summary of Content
8	D	5/23/2001	Aisin Seiki	Pajero HBB Accumulator - Summary of Actual Vehicle Assessment - Response to Question 8.	Based on the assessment for accumulators returned from the market, actual vehicles were fitted with accumulators having similar charged pressure and oil volume characteristics and then evaluated for stopping distance, brake performance in-use, and brake performance right after start.
9	M	5/24/2001	MMC	May 2001 Quality Meeting Minutes. Response to Question 8.	These are the minutes of the on-going discussions at the May 2001 Quality Meeting.
10	R	5/28/2001	Aisin Seiki	Improving HBB Accumulator. Response to Question 8.	The decisions were made to make a design change for reducing the thickness of the resin film from 1100 to 520 microns and to set the improved diaphragm specifications based on the assessment results.
11	R	6/15/2001	Aisin Seiki	Diaphragm-type Accumulator -Final Report- Response to Question 8.	This document summarizes the design change for the improved diaphragm-type accumulator as well as process improvements. The relevant companies (MMC, Aishin Seiki, Tokai Rubber) conduct a final debriefing session.
12	D	6/18/2001	MMC	CK HBB Accumulator Change. Response to Question 8.	Relevant departments were requested to provide the new accumulator design drawing as well as submit the Engineering Order.
13	D	6/19/2001	MMC	CK HBB Accumulator Change. Response to Question 8.	The accumulator was changed from June 19, 2001 in order to improve durability. The top of the new accumulators were marked in pink.
14	M	6/21/2001	MMC	June 2001 Field Fix Meeting Minutes. Response to Question 8.	The official decision was made at the June 2001 Field Fix Meeting to implement a field fix regarding the HBB accumulator issue.
15	R	7/23/2001	MMC	FMVSS Compliance Brake Test Results for CK HBB ACC with diaphragm Damage. Response to Question 9.	From the results of an investigation into parts returned from the market with diaphragm damaged ACCs, a condition which would have the most impact on brake performance, a simulated diaphragm damaged ACC was created and fitted in such condition, then brake performance was evaluated based on FMVSS 135. The results verify compliance with the relevant standard even under this adverse condition.

No	Type *	Document Date	Created by	Title	Summary of Content
16	D	7/31/2001	MMC	Improvement Campaign Notification Reference Document to Ministry of Land, Infrastructure, and Transport. Response to Question 8.	This is a reference document explaining to and summarizing for Japan's Ministry of Land, Infrastructure, and Transport details of the Improvement Campaign.
17	D	8/27/2001	Aisin Seiki	Pajero HBB Accumulator. Response to Question 8.	This document summarizes the cause of the diaphragm damage, countermeasures, and other preventative measures.
18	R	7/30/2002	Aisin Seiki	Pajero HBB Accumulator -Progress Status for Durability Testing-. Response to Question 8.	Each durability test is conducted until failure with the final specification diaphragm-type accumulator for which the results confirm the effectiveness of the final specifications.
19	D	5/11/2005	Aisin Seiki	Inquiry to Investigate Market Quality Issues. Response to Question 8.	This document outlines the cause of and countermeasure for damage to the accumulator lower shell seal surface.
20	D	11/18/2005	Aisin Seiki	Report on Pajero HBB Accumulator Lower Shell Damage. Response to Question 8.	This document includes an occurrence estimate for damage to the accumulator lower shell seal surface.
21	R	6/30/2006	Aisin Seiki	Assessment Results for Claimed Parts Returned to MMNA. Response to Question 8.	Assessment results for accumulators from 3 vehicles 2 vehicles : damaged diaphragm from die interference 1 vehicle : no irregularities
22	D	7/12/2006	Aisin Seiki	Mitsubishi Pajero Hyrdo Booster ACC Diaphragm Damage. Response to Question 8.	This document describes the diaphragm damage caused by die interference, countermeasures.
23	R	7/18/2006	Aisin Seiki	Accumulator Returned Parts List. Response to Question 8.	List of returned parts with accumulator problems investigated No. Returned : 73 units Investigation Results · 49 units : diaphragm damaged from die interference · 1 unit : accumulator lower shell surface damaged · 2 units : dealer mistakenly replaced accumulator without spring · 21 units : no irregularities

No	Type *	Document Date	Created by	Title	Summary of Content
24	D	7/19/2006	MMC	Response to Question 9.	Table summarizing all testing conducted by, or for, Mitsubishi to assess the performance of the brake system in the subject vehicles in the normal condition and in any and all "backup" conditions (e.g., loss of brake power assist, partial system failure).
25	D	7/19/2006	MMC	Response to Question 10.	This document identifies the changes and improvements (design, material, manufacture, quality control) made with respect to this defect from production start to the present.
26	D	7/19/2006	MMC	Response to Question 13.	This document identifies: 1) the relationship between brake line pressure and the brake pedal travel, and 2) the relationship between brake pedal travel and the force applied to the brake pedal, when the hydraulic brake booster assembly normally functioning and inoperative/depleted
27	D	7/28/2006	MMC	HBB System Summary Supporting documentation for answer to Question 14 (Attachment1)	System summary for HBB (Hydraulic Brake Booster) used for the Montero
28	D	7/28/2006	MMC	Explanation of HBB Accumulator damage after the recall countermeasure Supporting documentation for answer to Question 14 (Attachment2)	Explanation of cause and countermeasures for the diaphragm damage caused by die interference.
29	D	7/28/2006	MMC	Explanation of HBB Accumulator Phenomena Supporting documentation for answer to Question 14 (Attachment 3)	Explanation of phenomena when there is accumulator diaphragm damage
30	D	7/28/2006	MMC	Estimated Occurrence Supporting documentation for answer to Question 14 (Attachment 4)	Occurrence estimate for accumulator after countermeasures, extremely low in comparison to the occurrence rate before the countermeasures (recall)
31	D	7/28/2006	MMC	Opinions regarding 6 ODI Supporting documentation for answer to Question 14 (Attachment 5)	MMC's assessment with respect to the 6 ODI claims

No	Type *	Document Date	Created by	Title	Summary of Content
32	D	7/28/2006	Aisin Seiki	Investigation result of the accumulator returned from MMNA. Response to Question 8.	No problem was found as a result of the investigation.