



Mr. Jeffrey L. Quandt, Chief
Vehicle Control Division
Office of Defects Investigation
Room W48-312
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

November 10, 2011

Dear Mr. Quandt:

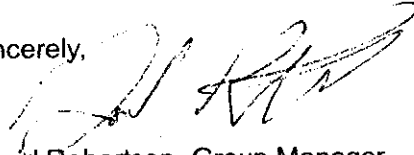
Enclosed is the complete response from Mazda, including sample parts, to your information request for PE11-026 (NVS-13cni sent on 9/1/2011). Previously Mazda has provided a partial response to this information request which included our responses for items 1, 2, 3, 4, 5, 6, 7, and 9 by the original due date of October 21, 2011. The attached document provides our response for the remaining items (8, 10, 11, 12, and 13) of your inquiry. We had received an extension to provide the complete response by November 11 in order to have sufficient time to complete our analyses. For your convenience we have included our previous responses so that the attached document contains Mazda's complete response to the information request.

In addition, Mazda provides amended data for request 5 (PE11-026 WARRANTY DATA.mdb) which is corrected from our earlier submission. We identified and have corrected the following errors from our original submission; the column "j_MASTER_CYL_RETURNED" for warranty claim number 88008-1, 108845-1, and 100048-1 are changed from "No" to "Yes".

As attached, we have sent a request to NHTSA's Chief Counsel requesting protection of confidential business information contained in some of the data appendices being provided electronically. This confidential business information is not contained in the enclosed CD-Rs being provided to you.

If you have any questions regarding the enclosed response, please let me know. My telephone number is (313) 594-7778 and my e-mail address is drobotson@mazdausa.com.

Sincerely,

A handwritten signature in black ink, appearing to read 'D. Robertson', written over a faint horizontal line.

David Robertson, Group Manager
Environmental, Safety and Powertrain Engineering
Mazda North America Operations

Encl: Two CD-Rs Titled PE11-026, Mazda Response (Final), 11/10/2011

Mazda's response: NHTSA Inquiry NVS-13cni, PE11-026

Request 1

State, by model year, the number of subject vehicles Mazda has manufactured for sale or lease in the United States. Separately, for each subject vehicle manufactured to date by Mazda, 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).

Provide the table in Microsoft Access 2003, or a compatible format, entitled "PRODUCTION DATA." See enclosure1, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer 1

Mazda records (as of September 28, 2011) indicate that the total number of subject vehicles manufactured for sale or lease in the United States (the 50 states and the District of Columbia) and its territories (Guam, Northern Mariana Islands, Puerto Rico) is 131,090. The breakdown by model year is as follows: MY2007 is 17,603, MY2008 is 36,984, MY2009 is 13,943, MY2010 is 33,487, and MY2011 is 29,073. Some vehicles, which have been imported into the United States, but are still not registered, are indicated as "USA" in the column of the state on the attached VIN list.

The requested data for each subject vehicle is provided electronically in Appendix_01 (filename: PE11-026 PRODUCTION DATA.mdb) on the enclosed CD.

Request2

State the number of each of the following, received by Mazda, or of which Mazda 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. Consumer complaints, including those from operators, where a failure or malfunction of the brake master cylinder or booster system was reported;
- c. Field reports, including dealer field reports;
- d. Field reports, including dealer field reports, where master cylinder leakage or failure was claimed;
- e. 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;
- f. Property damage claims;
- g. Third-party arbitration proceedings where Mazda is or was a party to the arbitration; and
- h. Lawsuits, both pending and closed, in which Mazda is or was a defendant or codefendant.

For subparts "a" through "f" 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 "e" through "h", provide a summary description of the alleged problem and causal and contributing factors and Mazda's assessment of the problem, with a summary of the significant underlying facts and evidence. For items g and h, 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 2

Consumer complaints (a, b):

Consumer complaints have been collected from the Mazda's Customer Assistance Center files maintained by the Technical Service Department (TSD) in Mazda North America Operations (MNAO). Considering the intent of the agency, Mazda accounted complaints which describe the master cylinder or brake booster function to be adversely affected as b. The number(s) of identified records which correspond to a or b of Request 2 are shown in the chart on the next page.

Field Reports (c, d):

Field Reports have been collected from the Mazda's Technical Hotline (HL) files, Product Quality Information (PQI) files, and Vehicle Inspection Report (VIR) files maintained by the TSD in MNAO. Considering the intent of the agency, Mazda accounted reports which describe the master cylinder or brake booster function to be adversely affected as d. The number(s) of identified records which correspond to c or d of Request 2 are shown in the chart on the next page.

Reports involving a crash, injury, fatality and fire (e):

One (1) record which corresponds to e was identified through the search of CAC, HL, PQI and VIR files. This complaint states when driving down hill and hit brake it did not respond and ended up hitting a pile of snow causing damage to front of vehicle. However, per the inspection at a dealership, the brake fluid level was low, but no brake performance problem was duplicated.

Property Damage Claims, Third-party arbitration and Lawsuits (f, g, h):

There were no records identified in a search of Mazda's legal files maintained by the Office of Counsel and Customer Mediation in MNAO, and the Office of Legal Affairs of Mazda that relate or may relate to the alleged defect.

These data gathering has been completed by October 3, 2011.

CHART 1

Number of records which relate to, or may relate to, the alleged defect in the subject vehicles:

Category	Number of records
a. Consumer complaint	3
b. Consumer complaints with failure or malfunction of the brake master cylinder or booster system (duplicate)	(1)
c. Field Reports	301
d. Field reports with failure or malfunction of the brake master cylinder or booster system (duplicate)	(12)
e. Reports involving a crash, injury or fatality (duplicate)	(1)
f. Property damage claims	0
g. Third-party arbitration	0
h. Lawsuits	0

Through the search for Request 2, Mazda identified 304 (a. + c.) records in total. When eliminating the duplicated VIN, these records were from 280 unique vehicles (VIN).

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. Mazda'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. Repair(s) dealer made to the vehicle;
- j. Whether a crash is alleged;
- k. Whether property damage is alleged;
- l. Number of alleged injuries,
- m. Number of alleged fatalities; and
- n. A summary of the incident.

Provide this information in Microsoft Access 2003, or a compatible format, entitled "REQUEST NUMBER TWO DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

Answer 3

The requested information, to the extent it is available, for the consumer complaints and field reports in response to Request 2 is provided electronically in Appendix_03 (filename: PE11-026 REQUEST NUMBER TWO DATA .mdb) 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 Mazda used for organizing the documents.

Answer 4

Information responsive to this information request related to the consumer complaints and field reports in the NNS (*) database at MNAO identified in response to Request 2 is provided electronically in the folder named Appendix_04 on the enclosed CD. These files are named with the file number which correspond with the information indicated in column "a. Mazda's file number" on the list provided for Request 3.

(*) NNS: New National System is a database system maintained by MNAO. It is core information system and supports various customer service activities such as customer relation, repair inquiry, warranty claim submission and the others.

Request 5

State, by model and model year, a total counts for all of the following categories of claims, collectively, that have been paid by Mazda to date that relate to repair or replacement of the subject component in the subject vehicles: warranty claims; extended warranty claims; claims for good will services; and field, zone, or similar adjustments and reimbursements. This should include all claims made in accordance with procedures specified in any service bulletins issued by Mazda related to the subject component.

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

- a. Mazda'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. Whether the master cylinder was returned for analysis;
- k. Concern stated by customer; and
- l. Comment, if any, by dealer/technician relating to claim and/or repair.

Provide this information in Microsoft Access 2003, 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 5

Records located, by model year, during a search of Mazda's warranty records, that relate to repair or replacement of the subject component, are shown in below chart.

	MY 2007	MY 2008	MY 2009	MY 2010	MY 2011	Total
Warranty claims	231	1147	252	38	6	1674
Extended warranty claims(*)	-	-	-	-	-	-
Claims for good will services	0	0	0	0	0	0
Field/zone adjustments	0	0	0	0	0	0
Warranty claims made in accordance with procedures specified in any service bulletins	0	0	0	0	0	0
Total	231	1147	252	38	6	1674

(*)Mazda does not offer extended warranty coverage for brake components

Mazda notes that it is difficult to accurately determine from each warranty claim whether it relates to the alleged defect. Please note that the warranty claims are submitted to Mazda by dealers to seek payment for repairs, which they have made, and often contain insufficient information to accurately determine why a repair was made, if the repair was appropriate, or even if the repair was necessary. In our opinion, the information provided in these warranty claims is insufficient to support a determination if they relate to the alleged defect in the subject vehicles.

These data gathering has been completed by October 18, 2011. To the extent that the requested information is available, it is included in the reports provided electronically in Appendix 05 (filename: PE11-026 WARRANTY DATA.mdb) on the enclosed CD.

Request 6

Describe in detail the search criteria used by Mazda to identify the claims identified in response to Request No. 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 Mazda 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 Mazda 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 6

The search criteria of warranty claims in response to Request 5 is as follows;

- The base part number of causal part is 4340Z which means the brake master cylinder.
- The base part number of causal part is 4380Z which means the brake booster, and the brake master cylinder is replaced together in that repair.

The list of all labor operations, labor operation descriptions, problem codes, and problem code descriptions ,may relate to the alleged defect is provided electronically in Appendix_06 (filename: Appendix_06.xls) on the enclosed CD.

For 2007-2011 model year Mazda CX-9 vehicles, Mazda provides basic warranty coverage of three years or 36,000 miles, whichever occurs first. Especially for powertrain, Mazda provides warranty coverage of five years or 60,000 miles, whichever occurs first. Mazda does not provide any extended warranty coverage option(s) which covers the brake components.

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 Mazda 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 Mazda is planning to issue within the next 120 days.

Answer7

Mazda has not issued any service documents that relate to, or may relate to, the alleged defect in the subject vehicles. Also there are no drafts of service documents planned to be issued within the next 120 days.

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, Mazda. 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 8

Please see the file "Appendix08.xls" stored in Appendix08 folder in the enclosed CD for the summary of actions conducted or scheduled. Relevant document for each item is also indicated in the spreadsheet with a file name and stored in the above-mentioned folder so, please refer to them as well.

As shown in "Appendix08.xls", the below-mentioned 3 factors are considered to be a cause of fluid leakage from master cylinder.

Factor (1) Primary plunger scratch caused by inappropriate part handling

As shown in Finding/Conclusion within Appendix08 Action No.2, Mazda assumed that the primary plunger would be dropped or hit and scratched while picking up after forming, and then brake fluid leaked around this scratch in vehicle usage. Because only 1 failure part is confirmed to be caused by this factor, Mazda judged this does not occur frequently.

Factor (2) Minute sliver/pitting caused by inappropriate surface finishing of primary plunger

As shown in Finding/Conclusion within Appendix08 Action No.3, Mazda assumed that some minute sliver/pitting are formed on primary plunger surface caused by inappropriate surface finishing within its grinding process, and the sliver/pitting brings small damage on the vacuum seal on each brake stroke in vehicle usage, resulting in a raking out of brake fluid on each brake stroke. Based on the fact that 5 failure parts are confirmed to be caused by this factor, and the warranty claim is largely reduced after the improvement for this factor, Mazda judged that this factor is the main cause of the alleged defect.

Factor (3) Contamination caused by inappropriate assembly of master cylinder

As shown in Finding/Conclusion within Appendix08 Action No.6, Mazda assumed that the primary plunger is damaged due to a misalignment of positioning jig in master cylinder assembly process, and the small aluminum piece, which came from the plunger damage, is contaminated in the master cylinder, resulting in a damage of the vacuum seal while vehicle usage. Because only 1 failure part is confirmed to be caused by this factor, Mazda judged this does not occur frequently.

Request 9

State the number of master cylinders and brake booster assemblies that Mazda has sold that may be used in the subject vehicles by part number (both service and engineering/production), and month/year of sale (*including the cut-off date for sales, if applicable*).

For each component part number, provide the supplier's name, address, and appropriate point of contact (name, title, and telephone number). Also identify by make, model and model year, all vehicle applications that use the component, whether installed in production or in service, and state the applicable dates of production or service usage.

Answer 9

The information in response to this request is provided electronically in Appendix_09 (filename: Appendix_09.xls) on the enclosed CD.

Request 10

Provide the following information regarding all warranty return analyses conducted by, or for, Mazda related to the alleged defect in the subject vehicles:

- a. An Excel spreadsheet listing all returns and including the following information:
 - i) Claim number;
 - ii) Vehicle identification number;
 - iii) Master cylinder information (e.g., manufacturing date,
 - iv) Repair date;
 - v) Repair mileage;
 - vi) Results of all testing conducted on the part (e.g., leak check); and
 - vii) Summary of warranty return analysis findings.
- b. Copies of all warranty return analysis reports, including all test results and photographs;
- c. Describe all failure modes identified in analysis of returned parts; and
- d. Describe and provide copies of all documents related to all analyses of return part inspections and testing.
- e. A description of how the subject vehicles were evaluated by Mazda in the recall decision making process, either during the reviews that led to recalls 08V-311 and 09V-431 or subsequently.

Answer 10

As shown in Appendix08, 7 master cylinder parts were returned from worldwide, and 2 of them were from United States. Also, as shown in Answer5, warranty information of master cylinder in United States, 8 parts were returned for all problem condition, but 6 of them were not for the fluid leakage (large brake pedal stroke – 5 cases, brake shudder – 1 case), therefore the remaining 2 cases seem to be related to the alleged defect (Warranty claim number:88008-1and 108845-1; these correspond the above 2 cases from United States). Here is the response to Request10 for these 2 warranty claim cases.

- a. Please refer to the file namely, "Appendix10.xls" stored in Appendix10 folder in the enclosed CD for requested information.
- b. Analysis result report is stored in Appendix10 folder in the enclosed CD. The report for warranty claim 88008-1 is Appendix10_88008-1.xls. This is actually same one with Appendix08_No8_InvestigationReport3(USA).xls for Appendix08. Also, the report for warranty claim 108845-1 is Appendix10-108845-1.xls. This is actually same one with Appendix08_No15_InvestigationReport4.xls
- c. Failure modes identified are:

Warranty claim No. 88008-1

Minute sliver/pitting were found on the primary plunger surface. Mazda assumed that this sliver/pitting caused small damage on the vacuum seal by plunger stroke, and resulting in a raking out of brake fluid when plunger returned. This corresponds with the Factor(2) described in Answer8.

Warranty claim No.108845-1

A scratch on the primary plunger and a small piece of aluminum (contamination) were found. Also, the vacuum seal was damaged. Fluid leak at the test with vacuum pressure -667bar, was observed. Mazda assumed that contaminated piece of aluminum caused the vacuum seal

damage while vehicle usage, resulting in a fluid leakage. This corresponds with the Factor(3) described in Answer8.

No warranty claims which corresponds with the Factor(1) described in Answer8 is reported from United States.

- d. Analysis of returned part is as follows:

Warranty application No.88008-1

As shown in Finding/Conclusion within Appendix08 Action No.3, Mazda assumed that, due to the inappropriate surface finishing in the primary plunger grinding process, minute sliver/pitting was formed, however, they were too small to detect in visual inspection and fell out from Tier2 supplier. And furthermore, the concern was not detected in the vacuum inspection process either then, it has been assembled on vehicle with that condition.

For improvement, aiming to reduce the forming of sliver/pitting, in Tier2 grinding process, slowed down the grinding wheel speed and changed in grade of it (Aluminum to Silicon carbide), and at the same time, coolant filtering system periodical maintenance frequency changed from 6 months to 1 month to keep the parts cool(as of 6/25/2008). As preventative actions from the concern falling out from the site, inspection process at Tier2, was enhanced (as of 6/25/2008). The details of those are indicated in the Appendix10_88008-1.xls, which was provided for Request 10 b..

Warranty application No.108845-1

As shown in Finding/Conclusion within Appendix08 Action No.6, because the contaminated piece of aluminum and the plunger have similar constituent, it is assumed that the piece of aluminum was came from the scratch of plunger. In a process where the primary plunger and spring are to be inserted to the master cylinder case, positioning jig alignment wasn't appropriate and that, plunger contacted master cylinder case inner surface at insertion process and damage occurred. A piece from the damage was contaminated.

Performance evaluation was satisfied and that when the parts dispatched from the supplier, the concern was not detected and fell out from the supplier then assembled to the vehicle.

For improvement, positioning jig dimension was adjusted to prevent misalignment, and check frequency of alignment was changed (monthly to per shift) (as of 7/19/2010). For further improvement against contamination, the ultrasonic cleaning before assembly was incorporated (2/7/2011). These are indicated in the Appendix10_108845-1.xls which is provided for the request 10 b..

- e. As described in Answer 8, Mazda has concluded that the prime root cause of this issue is inappropriate surface finishing of the primary plunger. We also believe that warranty application No. 88008-1 we described previously has been caused by this cause as well. Regarding this issue, in May 2009, Mazda determined that the risk of this issue was quite low because this issue could be fully noticed by the customer with the brake warning lamp illumination and could be repaired before the braking performance was affected as the fluid leak amount was rather small.

When we did such examination, we didn't perform any comparison verification with Nissan 08V-311 and 09V-431 recall cases directly. However, when we have gathered the information on these recalls this time, we have found that the root cause of those issues is poor machining of the internal groove of the master cylinder body where the seal is inserted, which has caused the gap to the seal, creating the leak path and resulting in continuous fluid leakage during engine operation due to negative pressure of brake booster. Therefore, we concluded that it has a different characteristic from our CX-9 fluid leak concern.

In addition, we conducted the comparison verification among Toyota 10V-499, Honda 10V-504 recall cases and this issue (It has been described in Action No. 5 of Appendix8). The fluid leak issue subject to those recalls was that leak path was formed by flipping over of seal, having resulted in continuous fluid leak during engine operation. Then, we concluded that risk of this issue is much different from that of CX-9 fluid leak issue. Therefore, as for CX-9 fluid leak issue, we have determined to continue to fix the concern through repair work when it occurs in the field.

Request 11

Provide the following sample parts related to the alleged defect in the subject vehicles and peer vehicles (one sample each for subject vehicles):

- a. One exemplar sample of the master cylinder sectioned or disassembled to show the leak path related to the alleged defect (i.e., seal and seal groove);
- b. One field return sample of a master cylinder assembly representing a "worst case" leak rate for the alleged defect, sectioned or disassembled to show the subject seal and groove; and
- c. One sample each of any kits that have been released by Mazda for use in repairs related to the alleged defect, or may be relate, to the alleged defect in the subject or peer vehicles.

In addition to the request samples, please provide a description of how field return parts were tested to assess "worst case" leak rates and provide the range, mean, standard deviation and maximum values measured by Mazda in field returns for each vehicle population (i.e., subject vehicles)

Answer 11

Regarding this request, our understanding is that subject vehicle is 2008MY CX-9 and peer vehicles are 2007MY and 2009-2011MY CX-9. Followings are explanation of each sample parts submission.

- a. We submit one master cylinder because it is consistent between subject vehicles and peer vehicles and there's no change. Exemplar sample of the master cylinder disassembled is enclosed. Parts structure is shown in Appendix11a and brake fluid leak path relevant to the issue is shown in Appendix11b with in the folder Appendix11 on enclosed CD.
- b. Unfortunately we can't submit the parts requested because all failure parts collected from the subject vehicles (2008MY CX-9 for US) are scrapped and further, there aren't any failure parts collected from peer vehicles. For your reference, we submit parts collected from CX-9 for Europe since the master cylinder part is identical and the similar failure occurred. This vehicle (JMZTB89A800102806; Produced on 9/19/2008) correspond with 2008MY vehicle. We disassembled the part in the same way as described above a. This is the only concern part that has been kept as of Oct. 21, 2011. Though we were planning to request the supplier to conduct the investigation, we cancelled that request and determined to send to United States from Japan, considering the lead time of transportation to U.S for providing it to the agency. Therefore, we have not been able to identify the root cause of fluid leakage for this particular part yet.
- c. Replacement parts applied to the subject vehicles and peer vehicles are the same. And the packaging style doesn't have any variation, either. This replacement parts is provided.

Test method for collected parts

Reproduce in-vehicle situation by applying vacuum pressure to the master cylinder and brake booster connecting area. Stroke plunger and see if there's any leakage.

Assessment on the worst case of leakage amount

Identified the worst case parts through measuring leakage of every collected parts, then, multiplied safety ratio "2" to define the maximum leakage amount. Similar inquiries regarding the assessment on the leakage amount is seen in Request12c and therefore, we explained the details there. Please refer to Appendix12c.xls which is stored in Answer12 folder on enclosed CD.

Leak rate range, mean, standard deviation, and maximum values of subject vehicles and peer vehicles

We didn't calculate since the quantity of collected parts was not sufficient to process statistics.

Request 12

Provide the following information comparing the alleged defect and its effect on vehicle braking performance in the subject vehicles:

- a. Describe the design of the master cylinder, including the subject seal and seal groove;
- b. Describe the manufacturing process for the master cylinder and identify all factors related to the alleged defect condition;
- c. Describe the leak rates associated with the alleged defect (maximum, mean and standard deviation), including a detailed description of how Mazda measured or estimated leak rate (e.g., field return analysis, analysis of leak volume by time or miles in service, etc);
- d. Describe the master cylinder reservoir construction, including a plot of fill height vs. volume with the nominal fill level and level at which the brake warning lamp illuminates shown;
- e. Service interval remaining between brake lamp illumination and partial system failure, including the following:
 - i) A detailed description of how Mazda conducted this analysis and all assumptions used;
 - ii) A discussion of differences between city drive cycles and highway drive cycles on both the time to failure and miles to failure analyses;
 - iii) A discussion of leak dynamics during driving and after each drive cycle; and
 - iv) Mazda's assessment of how the time to failure and mileage to failure data in field reports, complaints and warranty claims fit with the estimated intervals;
- f. The failure rate related to the alleged defect;
- g. Analysis of failure rates as a function of service time and mileage
- h. Mazda's estimate of the number of failures that resulted in a reduction in brake effectiveness (i.e., hydraulic circuit failure) and how this assessment was performed
- i. Mazda's assessment of the effect of the brake fluid leakage on brake booster assembly performance (using worst case fill volume); and
- j. The effect of hydraulic circuit failure on vehicle stopping distance.

Answer 12

- a. Please see Appendix12a.xls stored in Appendix12 folder on the enclosed CD for master cylinder design and behavior. The master cylinder doesn't contain a groove structure for seal to be set.

- b. Master cylinder component parts (Primary/Secondary plunger, Spring, Washer, Vacuum seal) are manufactured by Tier2 supplier and final assembly is performed by Tier1 supplier. Mazda assumed that the cause of the alleged defect had existed on the primary plunger production process and the master cylinder assembly process. For details, please see the Appendix12b.xls in Appendix12 folder on the enclosed CD.
- c. Among collected failure parts, we identified the one with maximum leak amount and multiply safety rate "2" to define the maximum leak amount. Brake fluid leak occurs every time when primary plunger strokes however, leak amount per stroke is so small and it is unmeasurable. We calculated leak amount of a stroke based on the total leak amount of multiple strokes of plunger. Representative value are: 0.0092cc at brake effort 50N; 0.0134cc at 100N; 0.0166cc at 150N.

Statistical values including maximum/mean/standard deviation were not calculated because sufficient numbers of parts were not collected.

Regarding leak amount change over time or driving time, fluid leak depends on primary plunger stroke alone as mentioned before. And therefore, we concluded it doesn't vary with time or period of driving time.

See Appendix12c.xls stored in Appendix 12 folder on the enclosed CD for more details.

- d. See Appendix12d.xls stored in Appendix 12 folder on the enclosed CD for reservoir construction and fluid volume level.
- e. We assume that approximately 7,000km driving is possible between the time when brake warning lamp illuminates and when brake functional malfunction occurs. See Appendix12e.xls stored in Appendix12 folder on the enclosed CD for calculation base.
- f. Fluid leak concern occurrence rate is 0.84% for the subject vehicles(2007-2011MY CX-9). See Appendix 12f.xls stored in Appendix12 folder on the enclosed CD for calculation base.
- g. Fluid leak concern occurrence ratio 3 years after the vehicle registration is presumed as 1.36%. On the other hand, the trend of warranty claims shows reduction tendency. Number of warranty claims per month is 14.7 in average after January 2011. Also, root cause of brake fluid leak is supplier manufacturing quality issue, which is not deteriorative issue. Based on that, we think this brake fluid leak problem decreases with time. See Appendix12g.xls stored in Appendix12 folder on the enclosed CD for detail.
- h. When certain amount of brake fluid leaks out by this concern, the brake warning lamp would illuminate. Only in case if the driver does not take appropriate action for it and continue to use, it results in the degradation of the brake performance. However, it is difficult to estimate the driver's response in technologically, Mazda unable to estimate the number of the case where the brake performance is adversely affected.
- i. With the brake fluid accumulated in the booster, we tested whether or not there's an influence on brake performance, and found out that there's no influence (The test report is presented in Answer8's attachment document of Appendix08_No13_Actuation_study_report.pdf). And, for seal part of brake booster, we use one that will not be influenced even if contacted with brake fluid, therefore, booster's air tightness will not be lost.
- j. Relevant to the concern, if disregard brake warning illumination and continue to use, there is a possibility that the fluid pressure won't be transmitted to the brake system at front right and rear left, due to the air ingestion in the primary fluid pressure circuit. Secondary circuit (front left and rear right brake), will function normally without losing brake fluid. In case primary system malfunction, braking will depends on secondary system alone and its stopping

distance will expand to 94.7m v.s. 50.0m at normal state when braking is performed starting from 100km/h(Ref: Test result of FMVSS105 one side system failure)

Request 13

Provide Mazda's assessment of the alleged defect in the subject vehicle, including:

- a. 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, including Mazda's assessment of the causes and contributing factors for all crash reports submitted in response to this information request;
- e. What warnings, if any, the operator of the vehicle would have that the alleged defect was occurring or subject system was malfunctioning, and
- f. The reports included with this inquiry.

Answer 13

- a. The main cause of the failure is the minute sliver/pitting on the surface of the primary plunger in the brake master cylinder due to the inappropriate surface finishing in grinding process. In order to reduce the forming of sliver/pitting, the following countermeasures have been taken as of 6/25/2008. Deceleration of the speed for the grinding wheel, changing the grinding wheel grade material from aluminum to silicon carbide. And, changed the maintenance interval for the coolant filter system from every 6 months to every month in order to maintain the cooling parts.
As prevention against the problem outflow, incorporate a visual inspection with a magnifying glass every 3 hours and an inspection of the surface roughness at every shift on 6/25/2008. As a result of these actions, no vehicles using the master cylinder, which is produced after that, did not show any failure with the same root cause.
- b. The minor scratches on the primary plunger in the brake master cylinder wears the vacuum seal, and every time the brake strokes, meaning that every time the brake pedal returns, brake fluid is raked out into the brake booster side and accumulates within the brake booster. The damage on the vacuum seal is not big enough to configure the leak path where fluid leaks out by the difference of pressure. Therefore, there is no possibility to lost brake fluid so rapidly.
- c. The brake fluid is raked out toward the brake booster, and the brake fluid level gradually lowered. But when the brake fluid level comes down to about the minimum level, the brake warning lamp is illuminated to warn a driver. When the user does not respond appropriately with the brake warning lamp illumination and keeps driving the vehicle, air ingestion into the primary system in the brake hydraulic circuit occurs, and degradation of the brake effectiveness. The fluid in the secondary circuit stays and functions normally, so it is still capable to slow down and stop the vehicle.
- d. With this concern, the brake warning lamp illuminates as a result of the brake fluid reduction, so a driver can recognize the malfunction. The braking performance at that point is not susceptible to the negative impact. Approximately 7,000km can be driven from the time of flashing of the brake warning light to the time of showing the negative impact on the braking performance, so the customer has enough time to take his vehicle to a dealership to have it serviced. Mazda, therefore, has judged that no unreasonable safety risk is present as a result

of this concern.

As shown in Answer2, the number of Field Reports is 301 (corresponds with Answer 2c), however, on 289 cases (96%), there are no report to allege some influence such as abnormal brake pedal feel or brake effectiveness problem, and assumed to be able to have repaired before the such influence.

We reported one case of the accident, as shown in Answer2, hitting a snow pile. (CAC File No. 134068520). There is a record that this customer only called the Customer Assistance Center, but the detailed vehicle information is not found. If this accident had caused by the subject concern, the brake warning lamp should have lit before the braking performance had been impacted, and the customer should have brought the vehicle into a dealership. The customer said that the braking performance was deteriorated, however, the brake fluid leak was found, the dealer could not duplicate the brake performance problem and did not confirmed the brake warning lamp illumination. Because it is difficult to occur brake performance problem caused by fluid leakage without brake warning lamp illumination, this incident assumed to be caused by any other factor.

- e. As mentioned at the Answer12d", when the brake fluid level reaches about the minimum level, the brake warning lamp should illuminate, and the driver can notice malfunction at that point. Approximately 7,000km can be driven from the time of the flash of the brake warning light to the time of showing the negative impact on the braking performance, so the customer has enough time to take their vehicle to a dealership to have it serviced.
- f. As for the VOQ #10419837 and #10421930, there were no records of bringing a vehicle as a result of the reported concern at a dealer or a record of the customers calling the Customer Assistance Center, so the detailed information is absent at Mazda. The vehicle in #10419837 is registered on 8/31/2007 and #10421930 is registered on 7/2/2007, and August 2011, when they reported the concern to NHTSA , was an overdue the warranted period, so the vehicle should have serviced with the customer-paid service, had the vehicle been brought to the dealership. It is assumed, therefore, that the customer will not submit an application of the warranty.

As mentioned above, the fluid leakage concern should be recognized with the illumination of the brake warning light, which means that the service could be done before the malfunction occurs. Considering the fact that almost vehicles are repaired before malfunction occurs, we are continuously going to monitor the occurrence of the issues and address and repair the concerns when they occur.

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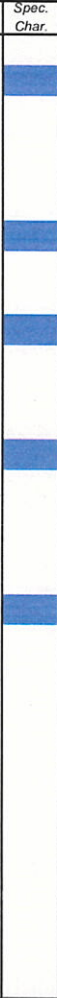
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Appendix 08

No3 work instruction 2

	Nr op. 0	WORKING INSTRUCTION			IS TROSR46-1.1	Spec. Char. +	Super Auto Forge Inc. - Novi
Assy line:	Number	Operation name	Product:	Customer	Part number:	Rev since:	
OP5	00	Attention of handling PP	Assy Primary Plunger	TRW		2008/4/20	
						since:	2007/3/16

DESCRPTION OF ACTIONS TO BE TAKEN DIAGRAMS PHOTOS	Spec. Char.	CONTROL
<p>Apply the standard below for handling PP after molding.</p> <p>1. Purpose: As containment action for coustomer claim of to detected damage, scratch, bumped 100% check/re-setting.</p> <p>2. After molding, must take out by one by all means.</p> <p>*This remit is applied to all employees. The person in charge reads this remit before every opening by all means, and be careful. The director goes around the workshop regularly, and confirm it.</p> <p>3. To be scraped it promptly if you find the defective article.</p> <p style="text-align: center;">Dispense with this introduction from Apr/20/2008!!</p>		

Requires level of quality <input type="checkbox"/>	Required calibration <input type="checkbox"/>	Number of Poka Yoke <input type="checkbox"/>	Number of masters (MBS) <input type="checkbox"/>	Process control chart (KKP) <input type="checkbox"/>	Work-in progress <input type="checkbox"/>	Fixture change required <input type="checkbox"/>	 Keep the standard Health and Safety procedures								
Received:	Operator.....		Date.....					<table border="1"> <tr> <td>Gloves</td> <td>Boots</td> <td>Glasses</td> <td>Other</td> </tr> <tr> <td style="text-align: center;">√</td> <td style="text-align: center;">√</td> <td></td> <td></td> </tr> </table>	Gloves	Boots	Glasses	Other	√	√	
Gloves	Boots	Glasses	Other												
√	√														

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Appendix 08

No3_work instruction2-original

	Nr op. 0	WORKING INSTRUCTION			IS TROSR46-1.1	Spec. Char. +	Super Auto Forge Inc. - Novi
Assy line:	Number	Operation name	Product:	Customer	Part number:	Rev since:	
OP5	00	Attention of handling PP	Assy Primary Plunger	TRW		2008/4/20	
						since:	2007/3/16

DESCRPTION OF ACTIONS TO BE TAKEN DIAGRAMS PHOTOS	Spec. Char.	CONTROL
<p>Apply the standard below for handling PP after molding.</p> <p>1. Purpose: As containment action for coustomer claim of to detected damage, scratch, bumped 100% check/re-setting.</p> <p>2. After molding, must take out by one by all means.</p> <p>*This remit is applied to all employees. The person in charge reads this remit before every opening by all means, and be careful. The director goes around the workshop regularly, and confirm it.</p> <p>3. To be scraped it promptly if you find the defective article.</p> <p style="text-align: center;">Dispense with this introduction from Apr/20/2008!!</p>		

Requires level of quality <input type="checkbox"/>	Required calibration <input type="checkbox"/>	Number of Poka Yoke <input type="checkbox"/>	Number of masters (MBS) <input type="checkbox"/>	Process control chart (KKP) <input type="checkbox"/>	Work-in progress <input type="checkbox"/>	Fixture change required <input type="checkbox"/>	 Keep the standard Health and Safety procedures								
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Gloves	Boots	Glasses	Other												
√	√														

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Appendix 08

No4_control plan2

CONTROL PLAN

Prototype		Pre-Launch		X Production		Key Contact/Phone					
Control Plan Number		Subassy Prim Plunger		Alberto Flores / 52-442-211.3352		Date(Orig.)					
Part Number/Latest change level		S/N		Core Team		Date(Rev.)					
Part Name/Description		Subassy Primary Plunger		Supplier/Plant Approval/Date		Customer Engineering Approval/Date (if req'd)					
Supplier/Plan TRW		Supplier Code		Other Approval/Date (if req'd)		Other Approval/Date (if req'd)					
Part/ Process Number	Process Name/ Operation Description	Machine, Device, Jig, Tools Etc. Mfg.	No.	Product	Process	Special Char. Class	Methods			Reaction Plan	
							Prod./Process Specification/	Evaluation Measurement	Sample Size		Sample Frequency
Receivin g	Material to incoming area		RM-001		Unload materials from truck		Visual	100%	100%	Work Instruction	Invoke suspect / non-conforming work instruction
Rec. Insp	Receiving and inspection		Rec Ins		See data base of incoming inspection		See receiving inspection sheet	Per Lot	According to Work Instruction	Receiving inspection sheets	Invoke suspect / non-conforming work instruction
Subassy Prim Op 15	Pin connecting to ring retaining		15.01	Connecting pin		<C>	Operator inspection - 01 Visual	1 piece	Per shift	Stack height probe at station 60, cut off test at station 70. Audit condition (E-07-F03)	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
			15.021	Retaining ring orientation		correct	Mechanical inspection - 01 Fixture	1 piece	100 %	Nest Fixture for inspection	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
Inspection Prim-Plu	Inspection		16.025		Microscope	All of damage	Microscope inspection - 01 Fixture	All	100 %	Work Instruction	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
			15.03	Assy Table	Assembly pin connect to ring retaining	<C>	Fixture-Sensor	1 piece	100 %	Work Instruction. Audit condition with mechanical fixture and sensor (E-07-F02)	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
SubAssy Prim - washer	Transport SubAssy Prim to washer		Info								(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
SubAssy Prim -	Transport SubAssy Prim to shaving		Info	Handling	Unload component from carrier device	correct assembly	Machine-maintenance/ Visual	Per shift	According to Work Instruction	Receiving maintenance sheets	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material

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No4_control plan2-original

CONTROL PLAN

Prototype		Pre-Launch		X Production		Key Contact/Phone					
Control Plan Number		Subassy Prim Plunger		Alberto Flores / 52-442-211.3352		Date(Orig.)					
Part Number/Latest change level		S/N		Core Team		Date(Rev.)					
Part Name/Description		Subassy Primary Plunger		Supplier/Plant Approval/Date		Customer Engineering Approval/Date (if req'd)					
Supplier/Plan TRW		Supplier Code		Other Approval/Date (if req'd)		Other Approval/Date (if req'd)					
Part/ Process Number	Process Name/ Operation Description	Machine, Device, Jig, Tools Etc. Mfr.	No.	Product	Process	Special Char. Class	Methods			Reaction Plan	
							Prod./Process Specification/	Evaluation Measurement	Sample Size		Sample Frequency
Receivin g	Material to incoming area		RM-001		Unload materials from truck		Visual	100%	100%	Work Instruction	Invoke suspect / non-conforming work instruction
Rec. Insp	Receiving and inspection		Rec Ins		See data base of incoming inspection		See receiving inspection sheet	Per Lot	According to Work Instruction	Receiving inspection sheets	Invoke suspect / non-conforming work instruction
Subassy Prim Op 15	Pin connecting to ring retaining		15.01	Connecting pin		<C>	Operator inspection - 01 Visual	1 piece	Per shift	Stack height probe at station 60, cut off test at station 70. Audit condition (E-07-F03)	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
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Inspection Prim-Plu	Inspection		16.025		Microscope	All of damage	Microscope inspection - 01 Fixture	All	100 %	Work Instruction	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
			15.03	Assy Table	Assembly pin connect to ring retaining	<C>	Fixture-Sensor	1 piece	100 %	Work Instruction. Audit condition with mechanical fixture and sensor (E-07-F02)	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
SubAssy Prim - washer	Transport SubAssy Prim to washer		Info								(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material
SubAssy Prim -	Transport SubAssy Prim to shaving		Info	Handling	Unload component from carrier device	correct assembly	Machine-maintenance/ Visual	Per shift	According to Work Instruction	Receiving maintenance sheets	(a) Review panel view and identify cause. (b) Correct (c) If it is not possible, notify to supervisor. (d) Follow work instruction: Control of non-conforming material



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Appendix 08

No10_work instruction3

No 4		WORKING INSTRUCTION			WASAF-3.0		 Super Auto Forge Ltd.	
Linia	Stan.nr	Nazwa operacji	Parts name:	Klient	No ups	Obowiązuje od:		
Machine #2		OD ECM process / Griding process	Primary Plunger	All	A001683	2008/4/14		
						Obowiązuje do:		
						2008/6/28		
OPIS Instruction / DIAGRAM / Procedure / 手順						Char. spec. CONTROL		
New Process						100% lack of surface scratches after disassembly/assembly		
1: Final Grinding Control Wheel Speed Reduced from 40 rpm to 20 rpm 最終研磨工程でのホイールスピードを40 rpm から 20 rpmへ減速						100% presence of components		
2: Coolant filtration system will be reviewed and improved TPM from 6 month to 1 month 研磨機の冷却濾過システムメンテナンス周期(半年に1回から月1回)を見直し								
3: Visual inspection of the parts has been introduced after the grinding operation at a frequency of 3/Hour using 10X magnification as per the boundary samples 研磨工程後、サンプルを用いての10X顕微鏡を使用して3時間の視覚的検査を導入。								
								
Working instruction 1						NIE		
Poka Yoke 0						0		
Customer (KKP)						Production No 2		
Department:						Rev		
Operator:						SI		
Data:						In		
						Char. CONTROL TABLE		



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No10_work instruction3-
original

No 4		WORKING INSTRUCTION			WASAF-3.0		 Super Auto Forge Ltd.		
Linia	Stan.nr	Nazwa operacji	Parts name:	Klient	No ups	Obowiązuje od:			
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						Obowiązuje do:			
						2008/6/28			
OPIS Instruction / DIAGRAM / Procedure / 手順						Char. spec.	CONTROL		
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1: Final Grinding Control Wheel Speed Reduced from 40 rpm to 20 rpm 最終研磨工程でのホイールスピードを40 rpm から 20 rpmへ減速						100% presence of components			
2: Coolant filtration system will be reviewed and improved TPM from 6 month to 1 month 研磨機の冷却濾過システムメンテナンス周期(半年に1回から月1回)を見直し									
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Working instruction 1						NIE			
Poka Yoke 0						0			
Customer (KKP)						Production No 2			
Department:	Operator:	Data:				Rev	SI	In	
						√	√		
						Char.	CONTROL TABLE		

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Appendix 08

No13_Actuation_study_report

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No13_Actuation_study_report-
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Appendix 08

No14_other_Mcyl_issue

MAZDA



CONFIDENTIAL BUSINESS INFORMATION

TRW

Master Cylinder

他社案件との不具合相違見解

Expertise for the difference from the case
occurred on other company

2010/Dec./15

Expertise for the difference from the case occurred on other company

[Expertise for the difference]


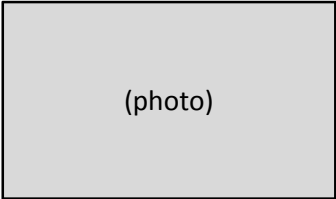
Because it is assumed that the lead time until air ingestion of the master cylinder upon the failure is different, the severity (nature of the problem) is different from the case occurred on other company.

(other company case: potential air ingestion in short period < -- > TRW: it did not reach to air ingestion in short period)

	Other company case	TRW failure
Failure mechanism	The <u>seal flips over</u> and brake fluid would leak. (Insufficient lubrication by the brake fluid which has less polymer)	Through the clearance between primary plunger and seal, brake fluid is scraped out into the vacuum booster. (Production problem on primary plunger)
Estimate	1) It is estimated that fluid leak rate is high when the seal flips over. (Because a leak path is configured) 2) Based on the fact that the countermeasure is "replacement of the seal", it is estimated as seal material/shape defect.	Amount of scraped brake fluid is very limited, it takes long period to scrape out. (If no brake attempt, fluid does not be scraped)
Expertise	There is possibility of "air ingestion at next brake attempt after flipping over of the seal". → Air ingestion of master cylinder directly causes "increased pedal stroke and problem of brake effectiveness". There is a possibility to be a unsafe situation without foreseeable phenomenon.	It is considered that "it does not come to an air ingestion of master cylinder immediately after the brake warning lamp on".

Expertise for the difference from the case occurred on other company

Supplemental explanation for “Estimation”

	Other company case	TRW failure
Problem Photo	 <p>(photo) (photo) (photo)</p> <p>(note: Photo shows an image of flipping over of seal. It is extreme case)</p>	 <p>(photo)</p>
Failure mode	<p>When the seal flips over, a gap is configured between plunger and seal. (no seal condition)</p> <p>→ “Leak path” for fluid leak is configured.</p> <p>→ Because problem area is seal against negative pressure chamber, the leakage is fueled.</p>	<p>Brake fluid is scraped out upon stroke. (If no brake attempt, fluid does not be scraped)</p>
Estimation	<p>After the flipping over of seal,</p> <p>→ It is estimated that “fluid leaks and it come to an air ingestion in short period.</p>	<p>Amount of brake fluid scraped is very limited. → It takes certain period of time to come to an air ingestion via scraping out.</p> <p>(Refer to the material MAZDA_J50_Mcyl_BrakeFluid_leakage_2010_12_09_ver01.pdf for the estimation of scraping amount)</p>

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Appendix 08

No14_other_Mcyl_issue-
original

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CONFIDENTIAL BUSINESS INFORMATION

TRW

Master Cylinder

他社案件との不具合相違見解

2010/Dec./15

他社案件との相違見解



【相違見解】

不具合発生時、M/Cyl.エア噛みに至るまでの時間の違いがあると推定されるため、他社案件とシビアリティー(問題の性格)は異なると考えます

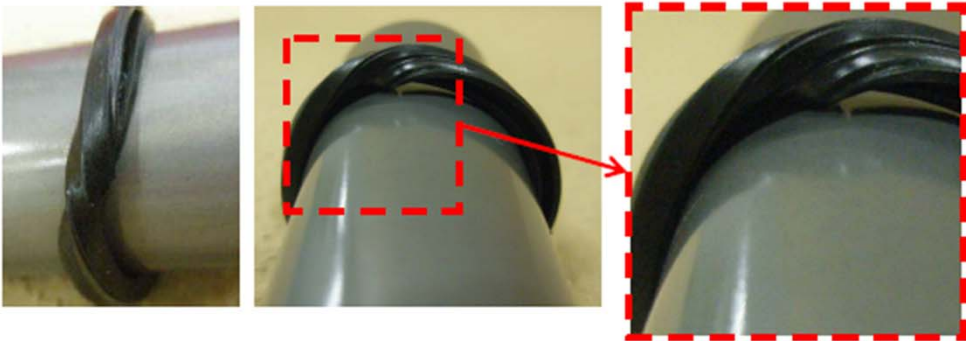
(他社案件: 早期にエア噛みの懸念有り ⇔ TRW: すぐにエア噛みには至らない)

	他社案件	TRW 不具合
不具合内容	シールがめくれ、ブレーキ液が漏れる (ポリマー成分の少ないブレーキによる潤滑不良)	Primaryプランジャーとシールの隙間から、ブースター内部へブレーキ液が掻き出す (Primaryプランジャーの製造品質不良)
推定	1) シールめくれ状態になると「ブレーキ液漏れは早い」と推定 (∵液路が形成されるため) 2) 対策が「当該シール交換」であることから、シール材料・形状に問題があったと推定	ブレーキ液掻き出し量は微小で、掻き出しには時間がかかる (ブレーキ作動が伴わない場合は掻き出さない)
見解	「シールめくれ発生後、次の制動時にはM/Cyl.にエア噛み」の懸念有り → M/Cyl.エア噛みによって、“ペダルストローク増加によるブレーキ効き不良”に直結、予見できず危険な状態となる 懸念有り	「ブレーキ警告灯点灯後、すぐM/Cyl.のエア噛みに至らない」と考える

他社案件との相違見解



「推定」補足説明

	他社案件	TRW 不具合
状況写真	 <p>(注:写真は、シールめくれのイメージであり、極端な状態)</p>	
発生内容	<p>シールめくれ時、<u>プランジャーとシールの間に隙間発生</u> (シールしない状態)</p> <p>→ブレーキ液漏れの“液路が形成”される →不具合部位は負圧室とのシールのため負圧による漏れ助長</p>	<p>ストローク時にブレーキ液掻き出し (ブレーキ操作ない場合は掻き出さない)</p>
推定	<p>シールめくれ状態発生後 →「ブレーキ液漏れ、エア噛みに至るのは早い」と推定</p>	<p>ブレーキ液掻き出し量は微小 →掻き出しによりエア噛みに至る時間はかかる</p> <p>(掻き出し量推定は、提出済み資料 MAZDA_J50_Mcyl_BrakeFluid_Leakage_2010_12_09 _ver01.pdf 参照)</p>

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11-10-2011

Appendix 08

No15_InvestigationReport4-
original

市場クレーム調査シート(購入品)

件名	ブレーキ効かず			発生年月日	2010/10/15
品質ランク	現象(故障状況)	故障モード	略 図	仕向地	U.S.A.
A B C	減速させ交差点を曲がろうとしたところ、ブレーキが効かず直進せざるを得なかった、との申し出。			車種	CX-9
				Car-No.	JM3TB28A4B0155623
			Eng/Min-No.		
				走行Km	31,363mile
				生産月日	2008/4/3
				発生件数	1
調査責任担当部署及び取引会社					
マツダ(株) 購入品品質部本社購入品品質Gr					
2010年 11月 19日発行					
クレーム品の調査結果		不良発生原因	不良流出原因	承認	審査
返却品の調査結果: 再現試験の結果、負圧-667barにて液漏れ再現を確認。マスターシリンダー分解調査の結果、アルミ製コンタミ混入を確認し、(プランジャー傷からの異物)・シールに磨耗を確認した。コンタミが原因でブレーキストロークを繰り返す際に、シールにダメージを与え、ブレーキフルード漏れに至ったと思われます。 又、市場での現象とフルード漏れの関係は、フルードレベルが下がれば警告等が点灯する事と、フルードが空になるまで使用される条件は考えにくい事から直接の関係は無いと思われます。		物理的 コンタミ混入の原因及び侵入経路については、アルミ製コンタミ(プランジャーと同等成分)から製造過程での考えられるリスクについて発生原因と致しました。 マスターシリンダーボディとプランジャーを挿入する工程に於いて使用するピストンツールの使用過程によるアライメントズレから、プランジャーとの干渉により発生した異物の混入が考えられます。又、プランジャー受け入れ時にプランジャー自体に付着していた異物の混入の可能性も考えられます。	性能評価では全て満足していた為、発見出来なかった。プランジャーの受け入れ検査では、目視で行う様指示されていたが見逃してしまった。	兼 森	二 反 田
Chemical Analyses  Contamination found in vacuum seal of the primary circuit is creating a leak path of brake fluid from the master cylinder. The composition of the metallic particles found show to be the same as the aluminum in the master cylinder primary plunger. This confirms that the plunger is a possible place of origin and not the master cylinder body.		管理的 ピストンツール交換・アライメントの確認周期については、T PMへ落とし込まれていたが、周期に誤りがあった。コンタミ混入リスクを想定していなかった。	管理項目に折り込んでいなかった。		
部品番号	類似部品/工程への予防処置		発生原因に対する恒久対策	購入品質部見解	
部品名称	御社様向けは、本工程以外御座いません。		1. ピストンツールの内面(受け側とのFit寸法)寸法を10mm~30mmにする事により、アライメントズレ防止(2010/7/19済み) 2. アライメント確認周期を1ヶ月毎からシフト毎に変更(2010/7/19済み) 3. プランジャーを工程に投入する前に超音波洗浄機で洗浄する(2011/2/7済み)	取引先責任 有 <input checked="" type="checkbox"/> 無 <input type="checkbox"/> 詳細調査結果より、負圧-667barにて液漏れが確認出来た。マスターシリンダー分解調査の結果、アルミ製コンタミ混入を確認し(プランジャー傷からの異物であると推測される)、シール部に磨耗(傷)を確認した。よって、アルミ製コンタミが原因でブレーキストロークを繰り返す際に、シール部へダメージを与えブレーキフルード漏れに至ったと推測する。問題の性格(多発性)に関しては、類似品他社様含め量産~2011/4現在約20万台生産しており、市場からの返却は一件のみ50PPmである為、多発性は低いと考える。しかしながら、左記対策を実施し、コンタミ低減に努める。 【Aランク会議クローズ済(4/21)】	
問題の性格(多発性の有無判断/根拠など)		流出原因に対する恒久対策		3ヵ月後の確認(マツダ)	
問題の性格:コンタミ混入により、使用過程に於いて徐々にシールにダメージを与えフルードがスローリーク現象で有り、製造当初は発見出来なかった。 多発性:本事象のクレーム事例は類似品他社様含めSOP~2011/4現在約20万台生産(御社向け)から1件である事・混入のリスクが低い事から、多発性は無いと判断致します。 50ppm = 1/200000		1. TPM/メンテナンス要領書の改定(2010/7/19済み) 2. プロセスフローに洗浄工程の追加(2011/2/7済み) 3. 洗浄工程の作業要領書作成(2011/2/7済み)		1. コントロールプランの改定(2011/2/17済み) 2. 受け入れ検査作業要領書の改定(2010/9/9済み)	
承認					
情報 No.	2AA2950621				

PE11-026

MAZDA

11-10-2011

Appendix 08

No16_SupplierReport4-original

MAZDA [REDACTED] **Master cylinder**



Brake fluid Leak from the Master cylinder



**Quality Information of the Market
No. 2AA2950621**

2011/Ari./8 Ver.05

マスターシリンダー 市場不具合品 調査



<目的>

市場で、“ブレーキマスターシリンダーからのフルード漏れ”という不具合が確認されたため、原因を調査する

<調査結果>

バキュームシールの摩耗+コンタミにより液漏れを起こした可能性あり

→ 本不具合の原因になるような事象を再現した

- マスターシリンダー 外部リークを確認

* ブースターと接続し負圧維持状態で、プランジャー周辺より液漏れ有り
(M/Cyl単体ストローク試験では液漏れ無し)

- 分解結果

* バキュームシール : 一部に異常摩耗と思われる箇所有り

* アルミニウム製のコンタミを確認

<考察>

* 今回のフルード漏れは、バキュームシール摩耗部から、ブースターの負圧によりブレーキ液が吸い出されたと考える

* シール異常摩耗原因の一つとして、コンタミ混入によりブレーキ操作時摺動する事により、バキュームシールの摩耗が促進されたことが考えられる

マスターシリンダー ブレーキ液 外部リーク 再現試験結果



試験開始 (負圧: -667mbar)

20分後: にじみ確認



再現条件

* 負圧保持

(試験負圧: -
667mbar)

* ブースター、M/Cyl
作動無し

40分後: にじみ拡大 明らかな液漏れを確認



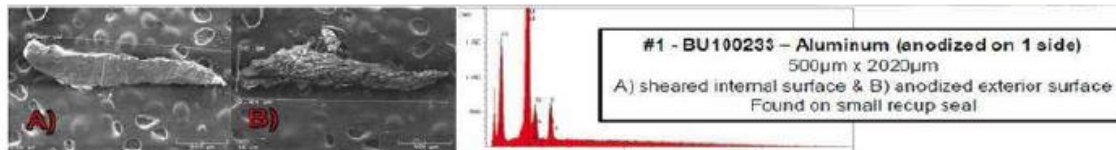
60分後: にじみ更に拡大 明らかな液漏れを確認



マスターシリンダー 分解結果-1



Chemical Analysis



- Contamination found in vacuum seal of the primary circuit is creating a leak path of brake fluid from the master cylinder. The composition of the metallic particles found show to be the same as the aluminum in the master cylinder primary plunger. This confirms that the plunger is a possible place of origin and not the master cylinder body.

アルミニウム製コンタミ確認:プライマリープランジャー傷から出たと思われる異物を確認(異物の分析結果アルミニウムでありプライマリープランジャーと同等成分)

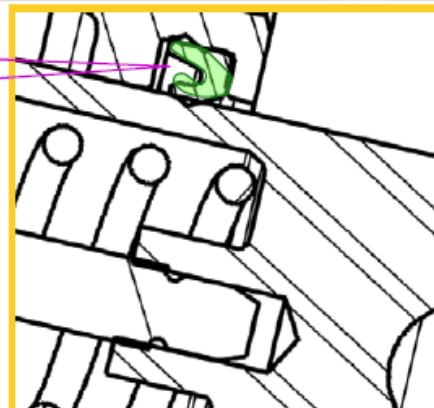


- Vacuum seal damage due metallic particle

コンタミ混入により、プランジャー作動からシールに磨耗を確認

コンタミ混入によるフルードリーク現象

コンタミがある事でプランジャーストローク毎にシールが擦れて磨耗する。(傷が出る)



L-seal
Transformation position

M/Cyl Bore

Cross section A-A

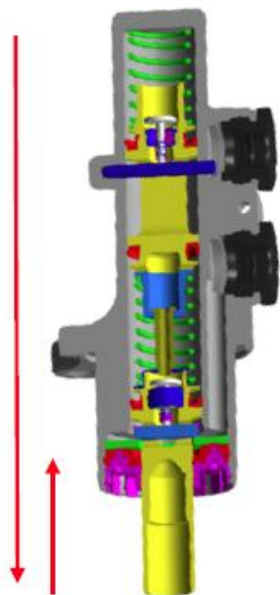
Plunger
Move to upward

シールに磨耗・傷が発生すると、プランジャーとの間に僅かな隙間が生じて、フルードがプランジャーの動作で掻き出されスローリークする。

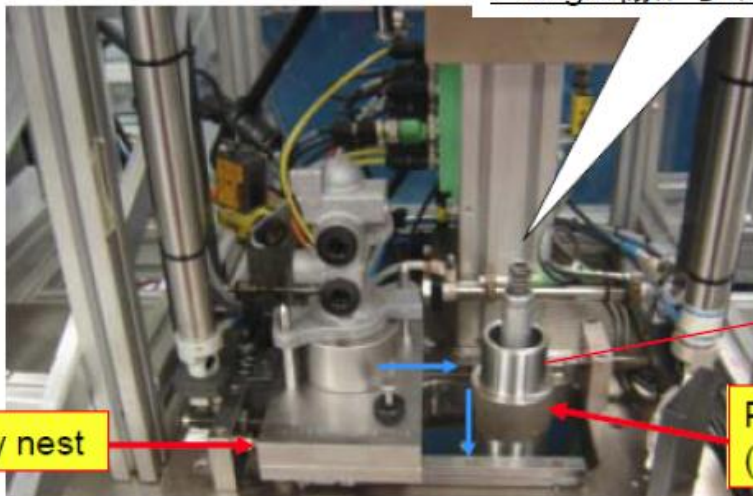
● Contamination

Op 60: Primary piston insertion

Primary Plunger にM/Cy bodyを挿入する際に、アライメントを行うツールの位置ズレで干渉してPrimary Plunger傷からの異物発生の可能性



MC body nest



Primary piston nest (insertion tool)

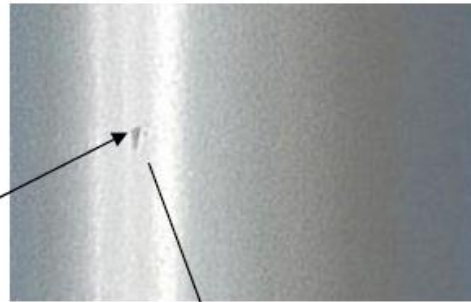


アライメントツール

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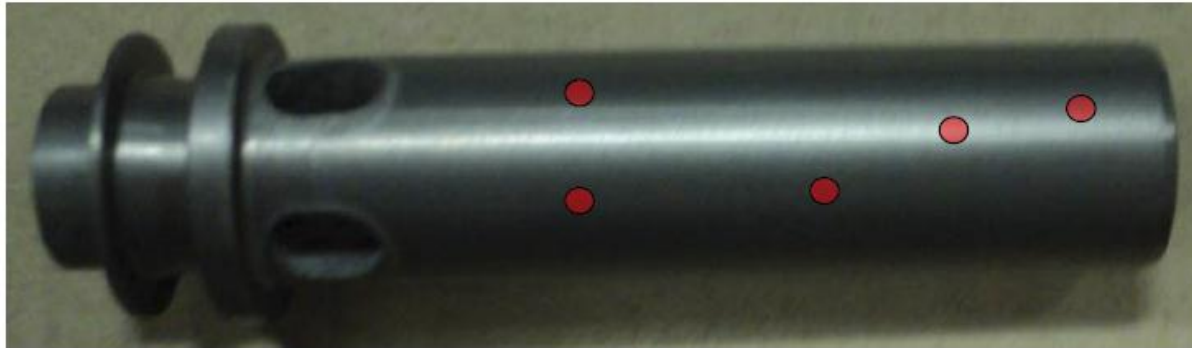
再現試験結果

Op 60 での再現試験の結果、ツールの位置ズレにより、プランジャーとマスターシリンダーボディが干渉して、プランジャーに傷が出来た事を確認。傷から出た、アルミ製破片が混入したまま組み立てられた可能性がある。



Due the nature of the nick. The damage was done after anodizing process

プランジャーに異物が付着したまま工程へ流動した可能性



● Contamination

Incoming condition of Plunger



The packaging is perfectly sealed and inside are the pistons in a tray where it enters each in place preventing this from hitting



Permanent Corrective Action 1



Improvement of piston insertion tools and nests and re-alignment assembly system.



After

Before

Marked distance was increased to allow the tool, to have a better alignment on the support.
Original distance was 10 mm, current is 30mm



The proper fit

Permanent Corrective Action 2



プランジャーを工程へ流動させる前に超音波洗浄にて異物の除去

Improve plunger washing process with the introduction of an ultrasonic alcohol washer.



PE11-026

MAZDA

11-10-2011

Appendix 08

No16_SupplireReport4

MAZDA [] Master cylinder

Brake fluid Leak from the Master cylinder

**Quality Information of the Market
No. 2AA2950621**

2011/Ari./8 Ver.05

Investigation of field concern parts for [] master cylinder

<Purpose>

Since the symptom that “fluid is leaked from the brake master cylinder” has been confirmed in the field, the root cause is studied.

<Investigation result>

Fluid leak may have occurred due to vacuum seal wear + contamination

→The phenomena that can be the root cause of this concern has been replicated.

- External leak of the master cylinder has been confirmed.

*Fluid leaks around the plunger when it's connected with the booster with the vacuum maintained.

(No fluid leak has been found in the master cylinder unit stroke test.)

- Result of disassembly

* Vacuum seal: Abnormal wear has been found partly.

* Aluminum contamination has been found.

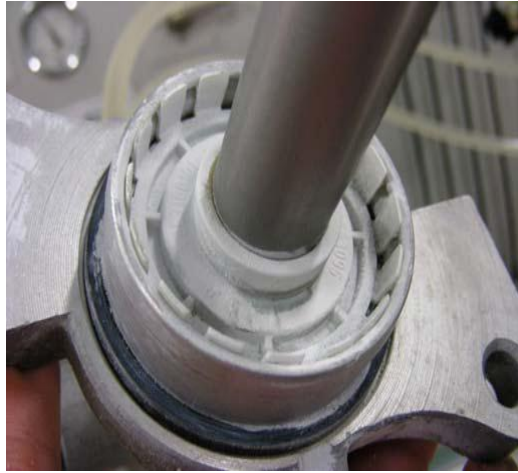
<Observation>

* This fluid leak is assumed that brake fluid has been sucked out from the vacuum seal friction spot due to the booster's vacuum.

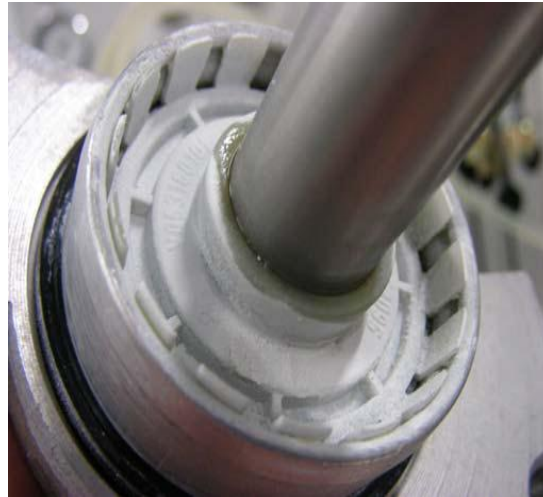
* As one of the reasons for abnormal seal wear, vacuum seal wear may have been advanced through the seal sliding when brake is applied because of contamination.

Reproduction test result for master cylinder's brake fluid external leakage

Test start (vacuum: - 667mbar)



20 min later: fluid began to leak



Reproduction condition
* Vacuum maintained
(Test vacuum: - 667mbar)
* Booster, master cylinder
not operated.

40 min later: Leak spread
and became obvious.



60 min later: Leak spread further
and became more obvious.

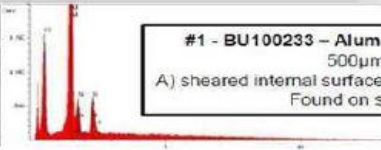
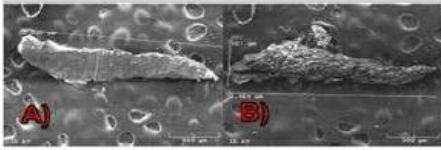


Master cylinder disassembly result-1



Master cylinder disassembly result-2

Chemical Analysis



#1 - BU100233 - Aluminum (anodized on 1 side)
500µm x 2020µm
A) sheared internal surface & B) anodized exterior surface
Found on small recap seal

- Contamination found in vacuum seal of the primary circuit is creating a leak path of brake fluid from the master cylinder. The composition of the metallic particles found show to be the same as the aluminum in the master cylinder primary plunger. This confirms that the plunger is a possible place of origin and not the master cylinder body.

Aluminum contamination was found: Foreign material seemed to have come from primary plunger scratch (As a result of foreign material analysis, it was confirmed to be aluminum that is the same constituent as primary plunger)

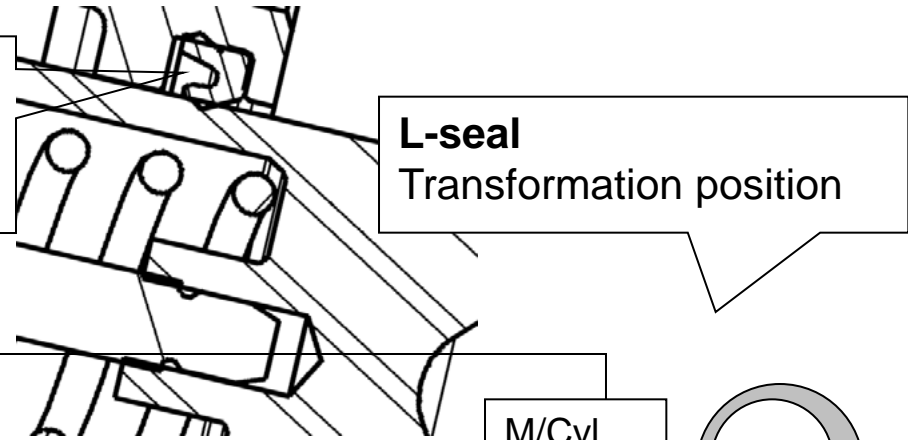
- Vacuum seal damage due metallic particle

Wear of seal due to contamination was confirmed through plunger operation.



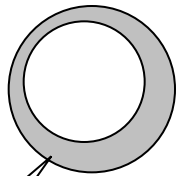
Fluid leak phenomenon due to contamination

Due to contamination, seal is rubbed at every plunger stroke, causing seal wear (with scratches formed)



L-seal
Transformation position

M/Cyl
Bore



Cross section A-A

Plunger
Move to upward

Part sketch

A

When wear and/or scratch occurs in the seal, it creates a small gap to the plunger. Then, fluid is scraped out by the plunger movement, resulting in the slow leak.

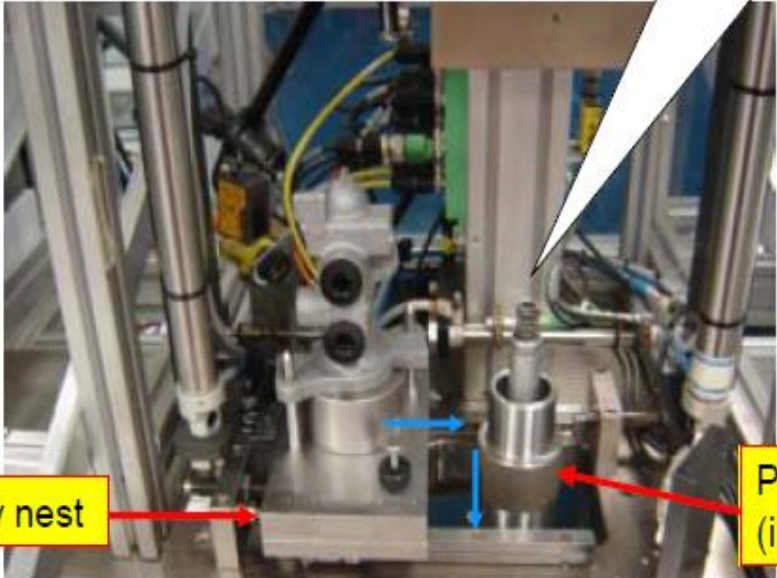
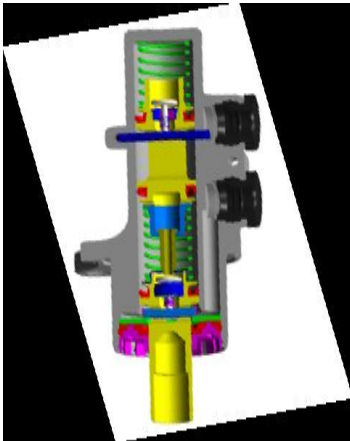
A

Contamination

Process that may have a risk of contamination-1

Op 60: Primary piston insertion

When master cylinder body is inserted into the primary plunger, both parts may interfere each other due to misplacement of alignment tool, which may cause foreign material generated from the primary plunger scratch.



MC body nest

Primary piston nest
(insertion tool)

Alignment tool

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Reproduction test result

As a result of reproduction test with **Op 60**, we verified a scratch was created after the plunger and the master cylinder body interfered each other due to the tool misplacement. There's a possibility that it may have been assembled with aluminum piece coming from the scratch included.



Due the nature of the nick. The damage was done after anodizing process

Estimated root cause of contamination-2

Possibility that the plunger with foreign material (contamination) attached may have been delivered to the process.



Contamination

Incoming condition of Plunger



The packaging is perfectly sealed and inside are the plungers in a tray where it enters each in place preventing this from hitting



Permanent Corrective Action 1

Improvement of piston insertion tools and nests and re-alignment assembly system.



After

Before

Marked distance was increased to allow the tool, to have a better alignment on the support.
Original distance was 10 mm,
current is 30mm



The proper fit

Permanent Corrective Action 2

Foreign material attached to the plunger is removed with the ultrasonic washing before the plunger is put into the process.

Improve plunger washing process with the introduction of an ultrasonic alcohol washer.



This action is
in process
will be ready
in April.

PE11-026

MAZDA

11-10-2011

Appendix 10

108845-1-original

市場クレーム調査シート(購入品)

件名	ブレーキ効かず			発生年月日	2010/10/15
品質ランク	現象(故障状況)	故障モード	略 図	仕向地	U.S.A.
A B C	減速させ交差点を曲がろうとしたところ、ブレーキが効かず直進せざるを得なかった、との申し出。			車種	CX-9
				Car-No.	JM3TB28A4B0155623
			Eng/Min-No.		
				走行Km	31,363mile
				生産月日	2008/4/3
				発生件数	1
調査責任担当部署及び取引会社					
マツダ(株) 購入品品質部本社購入品品質Gr					
2010年 11月 19日発行					
クレーム品の調査結果		不良発生原因	不良流出原因	承認	審査
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問題の性格:コンタミ混入により、使用過程に於いて徐々にシールにダメージを与えフルードがスローリーク現象で有り、製造当初は発見出来なかった。 多発性:本事象のクレーム事例は類似品他社様含めSOP~2011/4現在約20万台生産(御社向け)から1件である事・混入のリスクが低い事から、多発性は無いと判断致します。 50ppm = 1/200000		1. TPM/メンテナンス要領書の改定(2010/7/19済み) 2. プロセスフローに洗浄工程の追加(2011/2/7済み) 3. 洗浄工程の作業要領書作成(2011/2/7済み)		1. コントロールプランの改定(2011/2/17済み) 2. 受け入れ検査作業要領書の改定(2010/9/9済み)	
承認		承認			
情報 No.	2AA2950621				