

Mazda North American Operations

OFFICE OF DEFECTS &  
INVESTIGATIONS

2010 JAN 14 A 11: 59



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

January 13, 2010

Dear Mr. Quandt:

Enclosed is a response from Mazda to request 8, 9, 12, 13, 14 and 15 in your information request for PE09-045 (NVS-213dlr dated 10/26/09), as you granted an extension of time to January 15, 2010 to provide a response to the requests. Mazda has provided you with a response to request 1, 2, 3, 4, 5, 6, 7, 10 and 11, including sample parts, by original due date (December 18, 2009). We are claiming confidential treatment for the design information for the subject vehicle in the enclosed information.

If you have any questions or need further information please let me know. My telephone number is (313) 594-7778.

Sincerely,

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

for

David Robertson, Group Manager,  
Environmental, Safety & Powertrain Engineering  
Mazda North American Operations

enclosures

## Mazda's response: NHTSA Inquiry NVS-213dlr, PE09-045

### **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**

The item list of the investigation conducted by Mazda and the clutch pedal supplier with regard to this failure (Appendix\_08.xls) and related investigation materials are provided electronically in the folder titled Appendix\_08

Mazda has initiated the full-fledged investigation on this failure since February last year. As a result, it is assumed that if the sequence of clutch pedal fixing to body hasn't been appropriate, the clutch pedal would be distorted, causing bracket breakage due to stress amplitude through repetitive pedal operation.

### **Request 9**

Describe all modifications or changes made by, or on behalf of, Mazda 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 such modification or change, provide the following information:

- a. The date or approximate date on which the modification or change was incorporated into vehicle production;
- b. A detailed description of the modification or change;
- c. The reason(s) for the modification or change;
- d. The part numbers (service and engineering) of the original component;
- e. The part number (service and engineering) of the modified component;
- f. Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
- g. When the modified component was made available as a service component; and
- h. Whether the modified component can be interchanged with earlier production components.

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

### **Answer 9**

The information to this request is provided electronically in Appendix\_09 (file Appendix\_09.xls)

### **Request 12**

Provide copies of all documents related to the joint design represented by the clutch pedal mounting bracket, the fire wall (or bulkhead) and the attaching fasteners. Include metal thicknesses, fastener types and clamp loads (or bolt torque specifications).

**Answer 12**

The information in response to this request is provided electrically in Appendix 12 (filename Appendix\_12.xls)

**Request 13**

Provide the following information regarding the design of the subject component:

- a. A computer aided design (CAD) drawing of the clutch pedal assembly including the mounting bracket;
- b. A CAD model showing the attachment of the clutch pedal assembly to the firewall (or bulkhead);
- c. All finite element analyses conducted by or for Mazda of the clutch pedal assembly mounting brackets as assembled in vehicle position, including analyses at minimum and maximum attaching bolt torques and minimum and maximum driver force input; and
- d. All design and process FMEAs (Failure Mode Effects Analysis) related to the subject components including any FMEAs related to fatigue failures.

**Answer 13**

The information in response to this request is provided electrically in Appendix\_13 (filename:Appendix\_13a.xls for a CAD drawing of the clutch pedal assembly; Appendix\_13b.xls for a CAD model showing the attachment of the clutch pedal assembly to the firewall; Appendix\_13c.xls for finite element analysis; Appendix\_13d-1.pdf and Appendix\_13d-2.pdf for FMEA related to the subject component)

**Request 14**

Describe in detail all symptoms the operator may experience after the clutch pedal mounting bracket fails while the consumer is driving or shifting gears.

**Answer 14**

When the bracket is broken, the pedal pad leans to the right, which can be visually recognized. Then, when the clutch pedal is pressed, its feel becomes lighter and the clutch can be finally engaged after it is pressed all the way. And then, if the clutch pedal is operated more and more, eventually, even though the pedal is pressed all the way, the clutch is no longer disengaged, making gear shifting impossible. If this happens while driving a vehicle, gear change cannot be done and the engine is stalled when the vehicle is stopped by braking. After that, if the gear is turned to the neutral by moving the shift lever, the engine can be restarted. After the vehicle is stopped, as the clutch cannot be engaged and the gear cannot be shifted to the 1st, the vehicle cannot start off. However, no dangerous condition would occur such as unintentional runaway or braking not possible.

**Request 15**

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

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that it poses – include separate assessments of the risks associated with loss of clutch function and the potential for interference with brake pedal travel;
- e. Mazda's estimate, using statistical analysis of the failure data (e.g., Weibull analysis), of the percentage of subject vehicles that would experience the alleged defect within 3, 6 and 10 years of service;
- f. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring or subject component was malfunctioning; and
- g. The reports included with this inquiry.

**Answer 15**

a: The casual or contributory factor

There is a possibility that the sequence of clutch pedal fixing to body (3 locations) wasn't correct.

(Correct fixing sequence: 2 front locations fixed first → 1 upper rear location fixed. Assumed inappropriate fixing order was; 1 upper rear location fixed first → 2 front locations were fixed.)

b: The failure mechanism

As the pedal was fixed to the body in an incorrect order, the pedal bracket had distortion. Then, the stress amplitude that was generated during pedal operation went beyond the wear limit of the bracket, causing the bracket crack. By repeating pedal operation, it has ended up with the breakage of the bracket.

c: The failure mode

Edge of the bracket nut joint seating surface causes the crack, which gradually progresses to the breakage through repetitive pedal operation. During that process, when the pedal is pressed, abnormal noise occurs due to friction in the broken area. Also, the clearance appears in the bracket and the clutch release point is moved to the rear. When the bracket is finally broken, the clutch pedal leans to the direction of the brake pedal, and the push rod that is attached to the clutch pedal cannot be pushed in, making the clutch release impossible. Therefore, if this occurs when the gear is engaged, the gear cannot be shifted to the other gear, which leads to the engine stall due to the vehicle stoppage. Or if this occurs when the gear is in neutral, the gear cannot be shifted to any of other gears. In any case, it only makes clutch operation difficult and doesn't trigger any dangerous conditions like tire locked.

d: The risk to motor vehicle safety that it poses

After the clutch pedal bracket is broken, though the clutch function is finally lost, it's determined that risk is low because it doesn't trigger any dangerous conditions like unintentional runaway or vehicle not able to stop. After the bracket is broken, when the pedal is pressed, the pedal leans to the brake pedal for sure. But if the clutch pedal moves more than 33.5mm to the right compared to the correct position, the clutch cannot be released even though the clutch pedal is pressed, making gear shifting impossible. At that time, the distance between brake and clutch pedals is 25mm and both of those pedals aren't interfered each other. In other words, gear shifting becomes impossible before the failure affects the brake operation. So, it doesn't cause any dangerous conditions such as braking not possible. 102 cases of failure information we own (already provided to NHTSA) haven't represented any of cases such as interference between the brake pedal and the clutch pedal, and/or braking not possible at all. Therefore, it's determined that the risk is low.

e: estimate of the percentage of subject vehicle that would experience the defect.

If it's limited to 3 warranty symptoms that are assumed to be highly correlated to the symptom like clutch not able to release and gear shifting not possible, our assumptions are; 3 year occurrence rate = 0.09%, 6 year occurrence rate = 0.38%, 10 year occurrence rate = 1.05%. But it's difficult to determine whether all of the warranty claims correspond to the subject failure precisely. In the warranty claim submission process, the dealer requests payment of repair cost to Mazda. Thus, in some cases, we are not able to judge whether the repair was appropriate or not sufficiently. Therefore, we cannot say that this estimate of the occurrence rate corresponds to the failure correctly.

f: What warnings.

- When a crack is caused in the pedal bracket and is progressed, the abnormal noise begins to occur because bracket movement through pedal operation leads to friction between broken areas of the bracket crack.

- While repetitive pedal operation progresses the crack further, brackets on the body side and pedal supporting point side, which are fixed with nut, are detached, making the clutch pedal lean to the brake

pedal. At that time, push rod on the pedal side is collapsed in the clutch master cylinder, causing friction noise between metals.

As the clutch master cylinder is less pushed in by the push rod that is fixed to the clutch pedal, release of the clutch becomes more difficult.

g: The reports included with this inquiry

The information in response to this request is provided electrically in Appendix\_08 (file: Appendix\_08-16.xls)




PE09-045

MAZDA

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Appendix 13d-1

DFMEA		Part No.	Part Name		Auto Technica Corportaion													
		F151 41 300 (360F 41 300)		Clutch Pedal Assy														
Current Condition											Action Results							
Item / Function	Potential Failure Mode	Potential Effect (s) of Failure	Sev a	Class	Potential Cause (s) / Mechanism (s) Failure	Occur b	Current Design Controls / Prevention	Current Design Control / Detection	Dec c	R.P.N <sub>a×b×c</sub>	Corrective Action	Charging / Schedule	Action Taken	Sev A	Occur B	Det C	R.P.N <sub>A×B×C</sub>	
To keep suitable pedal depress force stroke characteristic.	Pedal arms do not have enough strength and stiffness.	Clutch system can not operate. (Hard operation of clutch system.)	8		Strength and stiffness of clutch pedal (41 031) are not enough.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	Set up floor stopper for the depressing heavy load durable strength test. Keep section modulus equal with J56 program. Heavy load durable strength test, Operating durable strength test, Load durable strength test	1	16	None							
	Pedal boss do not have enough strength and stiffness.	Clutch system can not operate.	8		Strength and stiffness of pedal boss (43 034) are not enough.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	NA01 43 034 (Carry over from current production.) Material SWCH10R / Outline $\phi 23$ / Inner diameter $\phi 17$ / L=36.45 Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	32	None							
		(Hard operation of clutch system.)	8	A	Welding length on pedal boss portion (43 034) is not suitable.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	Welding length 30 mm min. (as same specifications with current production.) Heavy load durable strength test, Operating durable strength test, Load durable strength test	3	48	None							
	Strength and stiffness of pedal plate is poor.	Clutch system can not operate.	7		Strength of pedal plate (43 032) is not enough.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	D350 43 032 (SPHN440W) / $\tau = 1.6$ / Proof strength 285 N/mm <sup>2</sup> min. Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	28	None							
		(Hard operation of clutch system.)	7	A	Welding length on pedal plate (43 032) is not suitable.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	Welding length 8 mm x 2 (as same specification with current production) Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	28	None							
	Strength and stiffness of fork joint portion is poor.	Clutch system can not operate.	8		Strength and stiffness of fork (41 141) are not enough.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	GA5R 41 141 (Carry over from current production.) Material SPH400W / $\tau = 2.3$ / Proof strength 235 N/mm <sup>2</sup> min. Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	32	None							
			(Hard operation of clutch system.)	8		Shaft diameter and material of joint pin (41 083) are not suitable.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	GA5R 41 083 (Carry over from current production.) Shaft diameter $\phi 8$ Material S25C Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	32	None						
			8		Shaft diameter and material of rod (41 131) are not suitable.	2	Should keep strength to endure heavy load durable test, operating durable strength test, and loading durable strength test.	Follow a design of 0118-41131 as current production. Shaft diameter $\phi 6$ Material S25C Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	32	None							
			8	A	Come off joint pin (41 083) from fork. (E ring is dropped.)	2	Specify to insert joint pin completely on the drawing.	Specify to insert joint pin completely on the drawing. Heavy load durable strength test, Operating durable strength test, Load durable strength test	3	48	None							
	Strength and stiffness of depressing side stopper portion is poor.	Reduce operation feeling.	8		Strength and stiffness of depressing side stopper (41 035) are not enough.	2	Should keep strength to endure heavy load durable strength, operating durable strength, and depressing side stopper durable strength.	Material SS400 / $\tau = 4.5$ / Proof strength 245 N/mm <sup>2</sup> min. Heavy load durable strength test, Depressing side stopper durability test	2	32	None							
8			A	Welding length on depressing side stopper portion (41 035) is not suitable.	2	Should keep strength to endure heavy load durable strength, operating durable strength, and depressing side stopper durable strength.	Welding length 8 mm Heavy load durable strength test, Depressing side stopper durability test	2	32	None								

DFMEA		Part No.	Part Name		Auto Technica Corportaion												
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Item / Function	Potential Failure Mode	Potential Effect (s) of Failure	Current Condition						Charging / Schedule	Action Results							
			Sev a	Class	Potential Cause (s) / Mechanism (s) Failure	Occur b	Current Design Controls / Prevention	Current Design Control / Detection		Dec c	R.P.N <sub>a×b×c</sub>	Corrective Action	Action Taken	Sev A	Occur B	Det C	R.P.N <sub>A×B×C</sub>
	Strength and stiffness of master cylinder bracket portion is poor.	Clutch system can not operate.  (Hard operation of clutch system.)	8		Strength and stiffness of bracket (41 071) is not enough.	2	Should keep strength to endure heavy load durable strength test, operating durable strength test, load durable strength test.	Material SPCN3 / t = 1.2 / Proof strength 110 N/mm <sup>2</sup> min. FEM analysis 99 N/mm <sup>2</sup> (Upper side is fixed.) Heavy load durable strength test, Load durable strength test, Operating durable strength test	2	32	None						
			8		Strength and stiffness of 41 076 bracket portion (reinforcement to improve joint portion with 071) are not enough.	2	Should keep strength to endure heavy load durable strength test, operating durable strength test, load durable strength test.	Material SPHN1 / t = 1.6 / Proof strength 195N/mm <sup>2</sup> min. Heavy load durable strength test, Load durable strength test, Operating durable strength test	2	32	None						
			8	A	Strength and stiffness of 41 076 bracket portion (reinforcement to improve joint portion with 071) are not enough.	2	Should keep strength to endure heavy load durable strength test, operating durable strength test, load durable strength test.	Satisfy MES CH 402. Specify sequence of spot welding points. Heavy load durable strength test, Load durable strength test, Operating durable strength test	2	32	Add 1 welding spot point due to increase margin of spot clearance. 	Aihara 2003/5/14	Added 1 welding spot point due to increase margin of sport clearance.	8	1	2	16
			8		Strength and stiffness of body mount face portion are not enough. 41 071 --- Body bracket 41 072 --- Front panel 43 065 --- Spacer	2	Should keep strength to endure heavy load durable strength test, operating durable strength test, load durable strength test.	Material of 071 SPCN3 / t = 1.2 / Proof strength 110N/mm <sup>2</sup> min. Material of 072 SPCN1 / t = 0.6 / Proof strength 145N/mm <sup>2</sup> min. FEM analysis 106 N/mm <sup>2</sup> (071) Use LA01 43 065 (current production) as spacer. Set up the part shape that can tighten up with maximum tightening torque to actual body. Heavy load durable strength test, Load durable strength test, Operating durable strength test	2	32	Change to forging spacer which seat is same size with diameter of nut. 	Hiura 2008/7/7	Changed to forging spacer which seat is same size with diameter of nut.	8	1	2	16
			8		PW of spacer (LA01 43 065) is incorrect.	2	Should keep strength to endure load until assemble with actual body.	Specify to must not take away until assemble with actual body on the drawing. Heavy load durable strength test, Operating durable strength test, Load durable strength test	2	32	Add clearance control standard. (Specify same control method with other FW parts on the drawing.) 	Hiura 2008/7/7	Applied the specification "Clearance should be 0.2 mm max. after weld." on the drawing.	8	1	2	16
Design suitable pedal return force.	Resistance can not be studied.	Pedal operation feeling is not good.	2		Moment by deadweight of pedal is not included.	2	Confirm moment by deadweight of pedal.	By conversion of pedal tread force - 0.3 N max.	2	8	None						
			3		Sliding resistance to rotate is too big caused by swaging of bolt direction on pedal fulcrum.	2	Confirm fixing tolerance and pressure tolerance.	Insert pressure force : 2646 - 3528 N Use same specifications with other production.	2	12	None						
			2		Sliding resistance to rotate is too big caused by swaging of radial direction on pedal fulcrum.	2	Confirm fixing tolerance.	Each tolerance of pedal fulcrum portion shall be carried over from latest J56 program. Clearance between boss and pin : 0.05 ± 0.12(←3σ) Clearance between pin and bracket : 0.13 ± 0.07(←3σ)	2	8	None						
			2		Sliding resistance to rotate is too big caused by incorrect material of bush.	2	Carry over from other current production.	Common use current production parts. Material POM (Oil impregnation) Apply EP2 grease.	2	8	None						
			5		Orientation of spring hook in pedal side is not correct.	2	Confirm bush angles at set position and full stroke position.	Sharp angle at both set position and full stroke position, not be occurred component force against out of spec. Operating durable strength test	2	20	None						
	Spring is taken off.	Clutch system is too heavy to operate.  (Pedal operation feeling is not good.)	5		Assist spring interfere with spring hook portion in pedal side.	2	Confirm the gap.	No interference with spring hook portion in pedal side. Operating durable strength test	2	20	None						



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Appendix 13d-2

