U.S. Department of Transportation

National Highway Traffic Safety Administration

ODI RESUME

OFFICE OF DEFECTS INVESTIGATION

NHTSA

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Investigation: PE 14-005
Date Opened: 02/10/2014
Date Closed: 06/26/2014
Investigator: Paul Simmons
Reviewer: Jeff Quandt
Approver: Frank Borris
Subject: Brake Booster Failure

MANUFACTURER & PRODUCT INFORMATION

Manufacturer: Mazda Motor Corp.
Products: 2010-2011 Mazda CX-9
Population: 62,319

Problem Description: Owners allege experiencing incidents of hard brake pedal feel and increased brake effort.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	24	84	102**
Crashes/Fires:	0	0	0
Injury Incidents:	0	0	0
Fatality Incidents:	0	0	0
Other*:	0	288	288

***Description of Other:** Warranty claims

** Total eliminates duplicates received by ODI and manufacturer.

ACTION / SUMMARY INFORMATION

Action: This Preliminary Evaluation is closed

Summary:

In March 2014, Mazda Motor Corporation (Mazda) initiated Special Service Program SSP93 to extend the warranty coverage for a specific brake booster fault condition on model year (MY) 2007-2013 Mazda CX-9 vehicles. According to Mazda's dealer communication for SSP93, the subject vehicles may exhibit a condition were the brake pedal is harder than usual to depress. Complainants report hearing air leakage (hissing) from the driver-side foot area during braking. The Mazda program extends the warranty coverage for repairing this condition to unlimited time and mileage for repairs performed between March 31, 2014 and March 31, 2015 and to 7 years or 90,000 miles for repairs performed after March 31, 2015.

In its response to the Office of Defects Investigation's (ODI) information request letter for PE14-005, Mazda identified a problem with booster diaphragms developing tears near the outer seal/circumference that can result in noise and degraded booster performance as the tears grow in length (Figures 1-3). The tears allow leakage from the ambient to the vacuum sides of the diaphragm that reduces the differential pressure across the diaphragm and produces a hissing noise after the tears have reached 10-12 mm in length. The problem was caused by wear of the mold used for the diaphragm forming process, which resulted in increased thickness and stress in the bending area of the diaphragm. Continuous operation in environments with high ambient temperatures accelerates the hardening of the diaphragm material, further increasing the stress in the bending area and contributing to tear initiation and propagation rate. Analysis of failure data indicates that the tool wear condition affected vehicles produced after June 2010 and operated in hot states (Figures 4-6). In February 2013 the supplier introduced a new mold and changes to the diaphragm thickness monitoring process to correct the condition in production vehicles.

Analysis of complaint and supplier test data indicates that the diaphragm tear condition is a progressive failure that develops slowly over time. Smaller tears have little effect on system performance. As the tear continues to grow, the effects become more evident. The hard pedal and increased effort are experienced during initial pedal application, but are diminished as the pedal is pressed further by the driver and the tear is partially sealed by the outer wall of the booster. This change from a hard to a soft pedal feel is described by some drivers as a spongy pedal. For tear lengths that were observed in warranty return parts, testing demonstrated that most booster performance can be recovered with increasing pedal apply speed and apply force. None of the tears measured in return parts grew large enough to cause a complete loss of brake booster function.

The booster diaphragm tear condition results in partial reduction in booster function that progresses gradually over time with audible and pedal feel symptoms available to the driver. The condition does not result in a sudden loss of power braking assist. The effects are evident during initial pedal apply and are reduced by increased pedal apply force and rate. ODI has not identified any accidents associated with the booster diaphragm tear condition in the subject vehicles. Accordingly, this investigation is closed. The closing of this investigation does not constitute a finding by NHTSA that a safety-related defect does not exist. The agency will continue to monitor complaints and other information relating to the alleged defect and take further action in the future if warranted.

VOQs (24) associated with this investigation: 10482005, 10486941, 10487938, 10493043, 10512943, 10523477, 10523719, 10533815, 10534545, 10535301, 10535955, 10542334, 10546804, 10546841, 10547859, 10550555, 10556021, 10560699, 10564520, 10565646, 10566803, 10573705, 10574868, 10575714

Figure 1. CX-9 brake booster assembly.

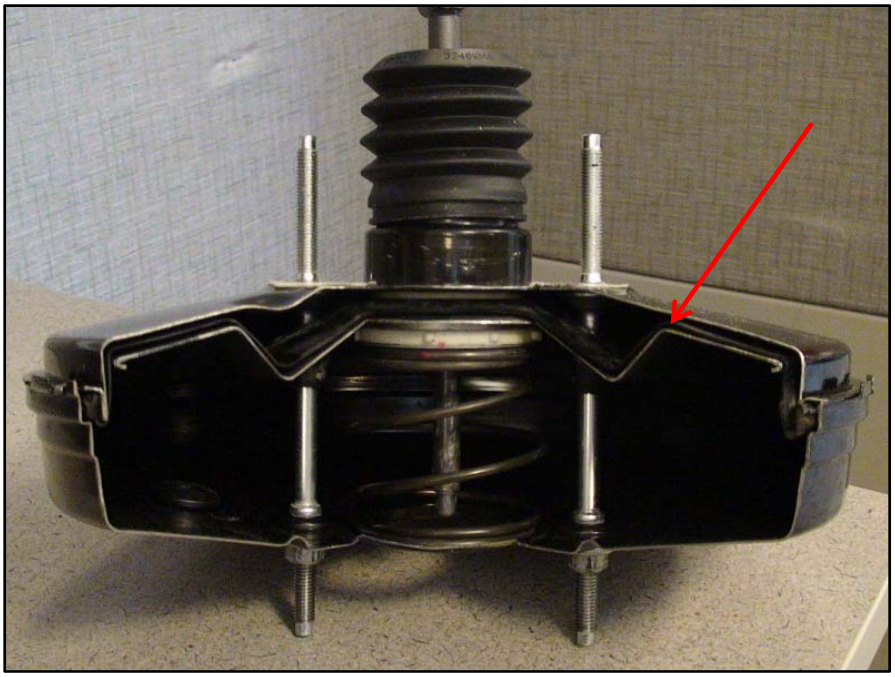

Figure 2. Booster cut-away showing diaphragm.

Figure 3. Diaphragm tear location (30 mm tear).

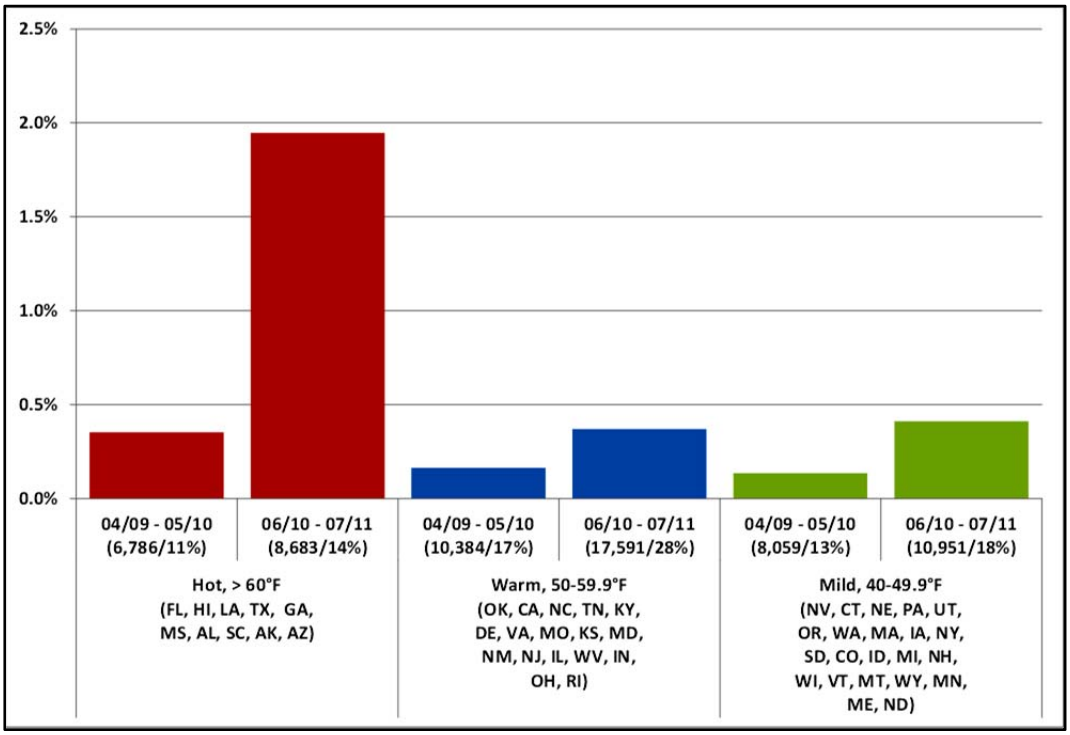

Figure 4. MY 2010-2011 Mazda CX-9 booster failure rates by production range and region.

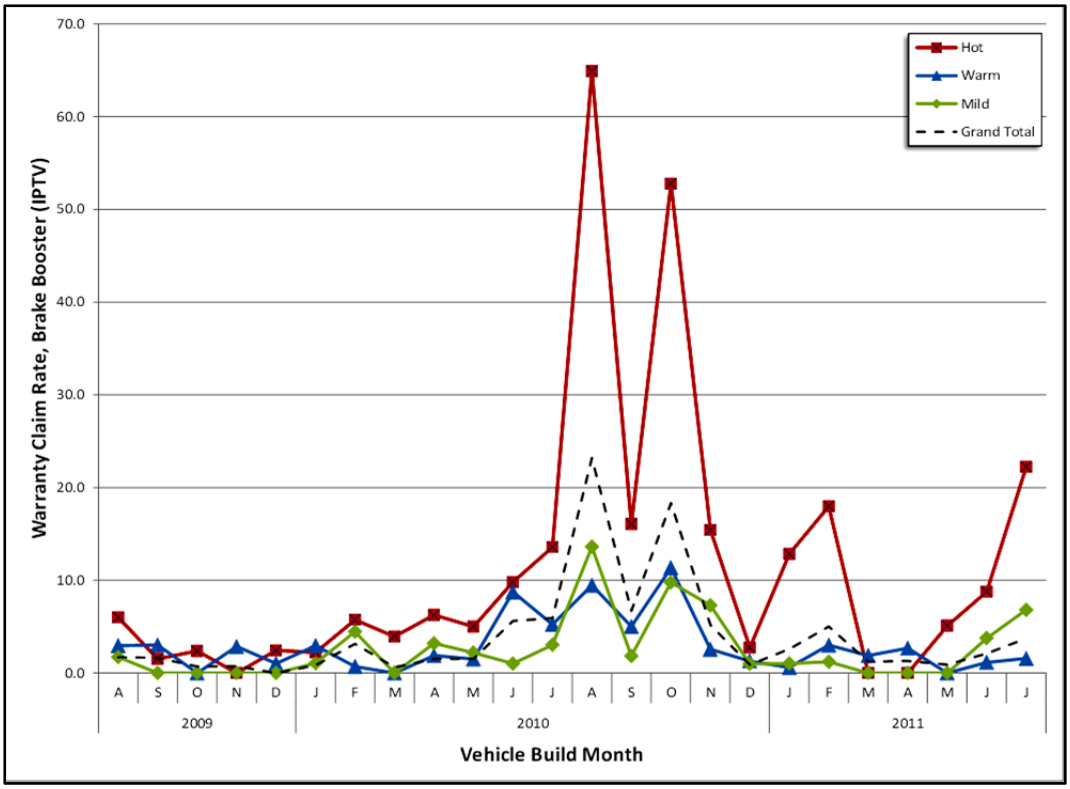

Figure 5. MY 2010-2011 Mazda CX-9 booster failure rates by region and vehicle build month.

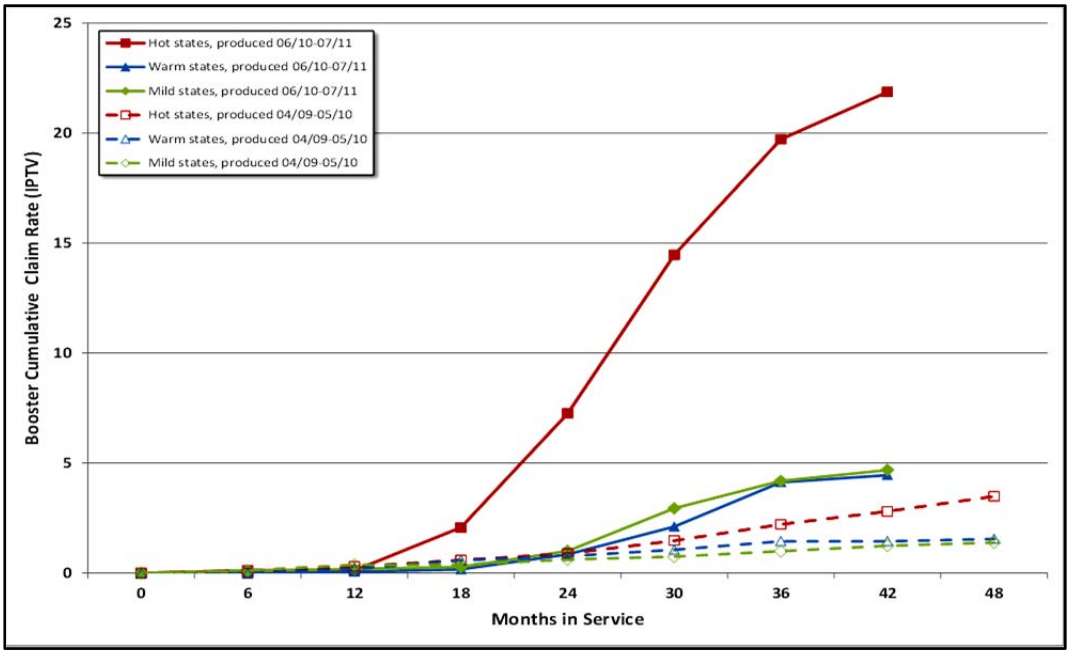

Figure 6. MY 2010-2011 Mazda CX-9 booster failure rate by region, production range and months in service.