



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

ODI RESUME

Investigation: EA07-015
 Prompted By: PE07-033
 Date Opened: 11/01/2007
 Date Closed: 10/28/2008
 Principal Investigator: Stephen McHenry
 Subject: Engine Stalling – Fuel pump failure

Manufacturer: General Motors Corp.
 Products: 2003 Chevrolet C avalier
 Population: 218,392

Problem Description: Fuel pump failure may result in engine stall with no restart.

FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
Complaints:	13	168	232
Crashes/Fires:	0	0	0
Injury Incidents:	0	0	0
# Injuries:	0	0	0
Fatality Incidents:	0	0	0
# Fatalities:	0	0	0
Other*:	0	1,523	1,523

*Description of Other: Warranty Claims for stalling while driving

Action: This Engineering Analysis is closed.

Engineer: Stephen McHenry *SMH*
 Div. Chief: Jeffrey L. Quandt
 Office Dir.: Kathleen C. DeMeter

Date: 10/28/2008
 Date: 10/28/2008
 Date: 10/28/2008

Summary: ODI's analysis of the stalling incidents that have resulted from subject component failures found that they can occur at any speed and generally result in a no restart condition. These are generally considered to be factors that increase the potential severity of stalling incidents. However, these incidents have occurred at relatively low rates in the subject vehicle population when compared with prior investigations involving similar categories of engine stall consequences. Even for the early MY 2003 production, where higher failure rates were noted, the rates of pump failures resulting in engine stall are lower than rates recorded in prior investigations of populations that were not recalled. Further investigation of this matter would not be an efficient allocation of agency resources. 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 in the subject vehicles and take further action in the future if warranted.

ENGINEERING ANALYSIS CLOSING REPORT

SUBJECT: Engine stalling due to fuel pump failure.

EA No: EA07-015

DATE OPENED: 01-Nov-07 **DATE CLOSED:** 28-Oct-08

SUBJECT VEHICLES: The subject vehicles are all model year (MY) 2003 Chevrolet Cavalier vehicles manufactured by General Motors Corporation (GM) for sale or lease in the United States.

SUBJECT COMPONENT: All fuel pump modules manufactured for use on the subject vehicles.

ALLEGED DEFECT: The fuel pump may fail resulting in an engine stall while driving with no restart.

VEHICLE POPULATION: 218,392

BASIS OF THE INVESTIGATION: On June 28, 2007, the Office of Defects Investigation (ODI) opened a Preliminary Evaluation (PE07-033) to investigate 13 complaints alleging engine stall due to fuel pump failure in the subject vehicles. The investigation was upgraded to an Engineering Analysis (EA07-015) on November 1, 2007. When EA07-015 was opened, ODI had received 54 complaints related to the alleged defect in the subject vehicles and, in its response to ODI's information request letter in PE07-033, GM had provided information about 158 complaints that it had received. Fourteen of the GM complaints related to incidents that had already been reported to ODI, resulting in a total of 198 unique complaints at the time of the upgrade. In the opening resume for EA07-015 ODI counted 4 crashes and 2 injury incidents resulting in 2 injuries for the subject vehicles. ODI subsequently determined that these crashes did not involve subject vehicles, but rather involved MY 2001 and 2002 Chevrolet Cavalier vehicles for which requested peer data had been provided by GM.

MANUFACTURER'S EVALUATION OF THE ALLEGED DEFECT: In its response to PE07-033, GM noted that during the evaluation of returned fuel pumps motor brush wear was found to be the cause of failure on 91% of the returned pumps. However, a comparison of the brush material of the returned pumps showed no difference to that of a new service part in chemical composition or hardness or in brush spring force. All three factors were within specified limits and normal variation.

GM stated that:

"The brushes and commutator of an electric motor are the key components of the electrical circuit, which allow the motor to convert electrical into mechanical energy. If the brush and commutator interface degrades (which was observed in the field return pumps), the electrical resistance across this junction will typically increase, and ultimately inhibit the flow of electrical current through the motor windings. If high contact resistance exists, the likely result is that the customer would initially experience a hard start or longer crank. As the condition progresses there would not be adequate starting torque to initiate rotation, and the pump motor will not operate.

"If a fuel pump in this condition starts, the engine/vehicle may operate normally. This is due to the lower electrical demand to maintain pump motor rotation and the reserve pumping capacity that is usually available when delivering fuel to the engine. As the commutator-brush

interface degrades and the electrical resistance increases, susceptibility to interruptions of the power and fuel delivery sufficient to cause an engine to stall increases.

"For these reasons, vehicles having fuel pump motors with high brush wear, will exhibit a predominant failure mode of a prolonged start or no start condition. This is reflected in the regular warranty data.

"Gasoline contains varying levels of peroxide, or sulfur (which may be elemental or corrosive). Peroxide, and/or sulfur, that can react with the copper commutator to corrode or roughen the surface of the commutator. As the carbon brushes contact the rough copper commutator they can wear at a higher than anticipated rate.

"In the fall of 2003, fuel companies began the process of removing sulfur from gasoline. Warranty data for the 2004 Model Year vehicle shows an even lower incident rate for stall or no start conditions when compared to 2001-03 Model Year vehicles. This data shows the influence of the fuel quality/composition on fuel pump life."

ODI ANALYSIS: ODI analyzed complaints and warranty claims related to the subject component by failure mode, reviewed design and process changes that could be related to the alleged defect, compared rates of subject component complaints and claims related to engine stall by model year for MY 2001 through 2004 Cavalier vehicles and compared the rates for the subject vehicles with vehicles previously investigated for issues that could result in engine stall. ODI's analysis found that the MY 2003 Cavalier vehicles have a higher complaint rate than the other MY 2001 through 2004 Cavalier vehicles, but a similar warranty claim rate to the MY 2001 through 2002 vehicles.

ODI analyzed information in the complaints to ODI and GM and in the warranty claim records provided by GM to determine the number of fuel pump module complaints and claims that resulted in incidents of stall while driving. Table 1 shows the percentage of warranty claims by the reported condition¹. Slightly over half of the claims were related to "no start" or "hard start" complaints and another 28 percent were related to problems with the fuel level sensor. This analysis showed that only about 12 percent of the claims involved a stall while driving incident.

Condition	Warranty Claims	Percent of Claims
No start or hard start	6,515	51.6%
Fuel level sensor problem	3,586	28.4%
Stalling	1,523	12.1%
Driveability (e.g., hesitation, reduced power)	999	7.9%

Table 1. Subject component warranty claims by condition, subject vehicles.

Information provide by GM indicates that the fuel pump design remained essentially the same for MY 2001 through 2004 Cavalier vehicles. Although there were some minor changes made throughout the production time period for the MY 2001 through MY 2004 vehicles, none corresponded with any observed changes in failure experience. ODI's analysis of complaints related to the alleged defect by MY (Table 2) shows that the complaint rate for the subject vehicles (106.2 per 100,000 vehicles) is about double that of the next highest model year, MY 2001, and ten times greater than MY 2004. Analysis of warranty data showed that the warranty claim rate for the subject vehicles is similar to the rates for the MY 2001 and 2002 vehicles. The complaint and warranty rates are significantly lower for the MY 2004 vehicles, which according to GM would not have been exposed to fuels that could be corrosive to the pump commutators. The only allegations of crashes or injuries involved MY 2001 and 2002 vehicles.

¹ This analysis only involved the approximately 84 percent of subject component warranty claims that contained sufficient information for ODI to assess the failure mode.

Model Year	Population	Complaints				Warranty Claims		Severity	
		ODI	GM	Total	R/100k	Claims	% of Population	Crashes	Injuries
2001	219,858	4	127	129	58.7	1,469	0.7%	1	0
2002	262,253	3	67	68	25.9	1,325	0.5%	2	1
2003	218,392	137	168	232	106.2	1,523	0.7%	0	0
2004	214,624	0	21	21	9.8	359	0.2%	0	0
Total	915,127	144	383	450	49.2	4,659	0.5%	0	0

Table 2. Complaints and Warranty Claims related to the Alleged Defect by Model Year.

REASON FOR CLOSING: ODI's analysis of the stalling incidents that have resulted from subject component failures found that they can occur at any speed and generally result in a no restart condition. These are generally considered to be factors that increase the severity of stalling incidents. However, these incidents have occurred at relatively low rates in the subject vehicle population when compared with prior investigations involving similar categories of engine stall consequences. Further investigation of this matter would not be an efficient allocation of agency resources. 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 in the subject vehicles and take further action in the future if warranted.

#