



GENERAL MOTORS LLC
Global Interior and Safety Center

April 8, 2011

Jeffrey L. Quandt, Chief
Vehicle Control Division
Office of Defects Investigation
National Highway Traffic Safety Administration
1200 New Jersey Ave., S. E., Room W48-307
Washington, D.C. 20590

N100425 Partial

NVS-213cnl
RQ10-004

Dear Mr. Quandt:

This letter is General Motors' (GM) partial response to your Recall Query (RQ), received on February 17, 2011 to investigate allegations of electric power steering (EPS) system failure in model year (MY) 2004 through 2007 Saturn ION vehicles manufactured by General Motors (GM) for sale in the United States, and to request certain information about these vehicles and similarly equipped peer vehicles.

As agreed upon in your email of March 24, 2011, this partial response contains the responsive information to request numbers 1, 7, 8, 9, 11, 12 and 15. The remainder of the response will be provided by the dates agreed upon in your email. Also, as agreed, GMs' responses will not include the Chevrolet Cobalt and the Pontiac G5.

In answer to questions 8 and 12, JTEKT North America has provided a disk labeled "CONFIDENTIAL BUSINESS INFORMATION / JTEKT NORTH AMERICA, INC. / DOCUMENTS PROVIDED TO GM IN CONNECTION WITH RQ10-004 / REQUEST NO. 8 and 12 / April 5, 2011". JTEKT's letter requesting confidential treatment of their information as well as their certificate in support of request for confidentiality are included on the disk.

Your questions and our corresponding replies are as follows:

1. **State, by model and model year, the number of subject and peer vehicles GM has manufactured for sale or lease in the United States. Separately, for each subject and peer vehicle manufactured to date by GM, state the following:**
 - a. **Vehicle identification number (VIN);**
 - b. **Make;**
 - c. **Model;**
 - d. **Model Year;**
 - e. **Plant of manufacture;**
 - f. **Date of manufacture;**
 - g. **Date warranty coverage commenced; and**
 - h. **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 Enclosure 1, Data Collection Disc, for a pre-formatted table that provides further details regarding this submission.

General Motors is providing the number of subject and peer vehicles equipped with EPS produced for sale or lease in the United States by make, model and model year in Tables 1-1 and 1-2, respectively, below:

MAKE	MODEL	2004MY	2005MY	2006MY	2007MY	TOTAL
Saturn	ION	121,107	71,023	96,227	94,118	382,475

TABLE 1-1 SUBJECT VEHICLES

MAKE	MODEL	2004MY	2005MY	2006MY	2007MY	2008MY	2009MY
Chevrolet	Malibu/Malibu Maxx	131,752	211,773	171,126	113,889	121,376	146,434
Pontiac	G6	0	62,360	149,845	52,325	68,405	45,044
Total		131,752	274,133	320,971	166,214	189,781	191,478

MAKE	MODEL	2010MY	2011MY	TOTAL 2004-2011
Chevrolet	Malibu/Malibu Maxx	165,754	144,374	1,206,478
Pontiac	G6	5,393	0	383,372
Total		171,147	144,374	1,589,850

TABLE 1-2 PEER VEHICLES

The production information requested in 1a-1h is provided on the ATT_1_GM disk; folder labeled "Q_01". Refer to the Microsoft Access 2003 file labeled: "Q_01_PRODUCTION DATA".

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

The service bulletins that may relate to the subject condition and have been issued to dealers, regional or zone offices, field offices, fleet purchasers or other entities are included in the ATT_1_GM disk; folder labeled "Q_07". This information was collected from GM Service Operations and was completed on March 9, 2011.

- 8. Provide a description of how the EPS system functions within the subject vehicles. In addition respond to these specific questions regarding EPS motor operation:**
- a. Describe the diagnostic logic for detecting and setting diagnostic trouble code DTC 0475 symptom 00, "Electric Steering Motor Circuit;"**
 - b. Describe whether and how the system detects a failure within the electric motor that would cause abnormal (too high or too low) current flow;**
 - c. State whether the system measures or estimate the voltage being applied to the motor, measure the current, and then compare the calculated motor impedance to the nominal expected motor impedance as a method of fault detection; and**
 - d. State whether and how the system can detect if some of the motor current is being shunted to the motor case.**

The electric power steering (EPS) system reduces the amount of driver effort needed to steer the vehicle. The system uses the body control module (BCM), power steering control module (PSCM), torque sensor, discrete battery voltage supply circuit, EPS motor, serial data bus and the instrument panel cluster (IPC) message center to perform the system functions.

The PSCM uses a torque sensor as its main input for determining the amount of steering assist. The steering column has an input shaft, from the steering wheel to the torque sensor, and an output shaft from the torque sensor to the steering shaft coupler. The input and output shafts are separated by a torsion bar, where the torque sensor is located. The sensor consists of a compensation coil, detecting coil and 3 detecting rings. These detecting rings have toothed edges that face each other. Detecting ring 1 is fixed to the output shaft; detecting rings 2 and 3 are fixed to the top of the input shaft. The detecting coil is positioned around the toothed edges of detecting rings 1 and 2. As torque is applied to the steering column shaft the alignment of the teeth between detecting rings 1 and 2 changes, which causes the detecting coil signal voltage to change. The PSCM recognizes this change in signal voltage as steering column shaft torque. The compensation coil is used to compensate for changes in electrical circuit impedance due to circuit temperature changes from the electrical current and voltage levels as well as ambient temperatures for accurate torque detection.

The EPS motor is a 12-volt brushed DC reversible motor with a 58-amp rating. The motor assists steering through a worm shaft and worm gear located in the steering column housing.

The PSCM uses a combination of torque sensor inputs, vehicle speed, calculated system temperature and the steering calibration to determine the amount of steering assist. When the steering wheel is turned, the PSCM uses signal voltage from the torque sensor to detect the amount of torque being applied to the steering column

shaft and the amount of current to command to the EPS motor. The PSCM receives serial data from the engine control module (ECM) to determine vehicle speed. At low speeds more assist is provided for easy turning during parking maneuvers. At high speeds, less assist is provided for improved road feel and directional stability.

The PSCM will go into overload protection mode to avoid system thermal damage if the driver turns the steering wheel in either direction several times until it stops or holds the steering wheel in the stopped position for an extended amount of time, as stated in the owner's manual. In this mode the PSCM will limit the amount of current commanded to the EPS motor and the driver may notice a reduced amount of power steering assist. The normal amount of power steering assist should return shortly after a few normal steering movements.

The PSCM also chooses which steering calibration to use when the ignition is turned ON, based on the production map number stored in the BCM. The PSCM contains all 8 of the steering calibrations which are different in relation to the vehicles RPOs. The PSCM has the ability to detect malfunctions within the EPS system. Any malfunction detected will cause the driver's information center to display "PWR STR". If the history code C0475 has been set, it will clear from the PSCM after 100 ignition cycles.

The responsive information requested in 8a-d is provided on the "CONFIDENTIAL BUSINESS INFORMATION / JTEKT NORTH AMERICA, INC. / DOCUMENTS PROVIDED TO GM IN CONNECTION WITH RQ10-004 / REQUEST NO. 8 and 12 / April 5, 2011" disk; folder labeled "JTEKT-Documents Related to Request Number 8".

9. **If any of the subject vehicles comes equipped with an electronic stability control (ESC) system, if not previously answered in Question 7, please describe:**
- a. **The function of the ESC;**
 - b. **Specifically how that system interacts with the EPS; and**
 - c. **Explain how the ESC system responds when an EPS fault is detected.**

Electronic Stability Control was not available on the subject vehicles.

11. **State the number of EPS system components; including motors, control modules, steering torque and position sensors, and steering column assemblies; that GM 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.

An electronic summary table of the requested service part information for the subject components is provided on the ATT_1_GM disk; folder labeled "Q_11".

These sales numbers represent sales to dealers in the United States. This data has limited analytical value in analyzing the field performance of a motor vehicle component because the records do not contain sufficient information to establish the reason for the part sale. It is not possible from this data to determine the number of these parts that have been installed in the subject vehicles or the number remaining in dealer or replacement part supplier inventory.

This table contains service part numbers, part description, part usage information including the GM vehicles that contain the identical component, part sales figures by month and calendar year, and the supplier's name and address, contact name and phone number.

12. In addition to the request above, is GM aware of any EPS assist component(s), specifically the electric assist motor used in the Chevrolet Cobalt, can be installed as a replacement part for the EPS assist motor installed in the subject vehicles.

Responding specifically with respect to the electric assist motor, although the Chevrolet Cobalt EPS assist motor had the same part number as the assist motor for the Saturn ION it was not available as a service replacement part for the Saturn ION until May of 2009.

Before May of 2009 replacement of the entire steering column assembly, which includes the EPS motor, was required when any component of the steering column assembly required replacement. Even today, the column is not interchangeable as a separate service part due to vehicle specific software which can only be flashed at the supplier.

The EPS motor became available as a service kit for the subject vehicles in May of 2009. While the EPS motor used in the Chevrolet Cobalt can be installed as a replacement part for the EPS motor in the Saturn ION, there are design differences over the model years.

Part design changes over model years may make Saturn ION EPS systems perform differently due to component design. These differences/changes are:

In 2004 model year Saturn IONs, the coupling piece between the motor and the worm gear was smooth. When the Chevrolet Cobalt began production in the 2005 model year, the coupling design was changed. One of the changes was to include grooves on the outer diameter along the length of the coupling on both the Saturn ION and the Chevrolet Cobalt. Refer to CONFIDENTIAL BUSINESS INFORMATION / JTEKT NORTH AMERICA, INC. / DOCUMENTS PROVIDED TO GM IN CONNECTION WITH RQ10-004 / REQUEST NO. 8 and 12 / April 5, 2011 disk; folders labeled "JTEKT-Documents Related to Request Number 12", then "Q_12_a".

Before the 2005 model year, the motor shaft bearing had a labyrinth type non-contacting particulate seal. Bearings in vehicles built in the 2005 model year and later, had a particulate seal with no labyrinth. Refer to CONFIDENTIAL BUSINESS INFORMATION / JTEKT NORTH AMERICA, INC. / DOCUMENTS PROVIDED TO GM IN CONNECTION WITH RQ10-004 / REQUEST NO. 8 and 12 / April 5, 2011 disk; folders labeled "JTEKT-Documents Related to Request Number 12", then "Q_12_b".

Some of the 2006 model year vehicles and later models (ION and Cobalt) had an o-ring seal between the motor and the housing.

15. Provide one sample for each of the following:

- a. One exemplar sample of each design version of the subject system for the subject vehicles;**
- b. Field return sample of the subject system, or any component of the subject system exhibiting the subject failure mode; and**
- c. Any kits that have been released, or may be relate, to the alleged defect in the subject vehicles.**

Enclosure 15 contains a field return sample of the subject component exhibiting the subject failure mode for the EPS column and two versions of new EPS motor kits. Some of the design versions installed in the subject vehicles are no longer produced for production or service.

* * *

General Motors requested assistance from suppliers in responding to items 8 and 12 and this response includes those components received from suppliers.

GM claims that certain information, in documents that are part of lawsuit and claims files maintained by the GM Legal Staff, is attorney work product and/or privileged. That

information includes notes, memos, reports, photographs, and evaluations by attorneys (and by consultants, claims analysts, investigators, and engineers working at the request of attorneys). GM is producing responsive documents from claims files that are neither attorney work product nor privileged, and withholding those that are attorney work product and/or privileged.

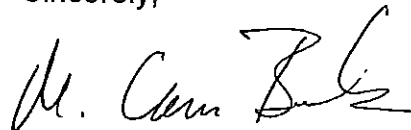
This response is based on searches of General Motors Corporation (GM) locations where documents determined to be responsive to your request would ordinarily be found. As a result, the scope of this search did not include, nor could it reasonably include, "all of its past and present officers and employees, whether assigned to its principal offices or any of its field or other locations, including all of its divisions, subsidiaries (whether or not incorporated) and affiliated enterprises and all of their headquarters, regional, zone and other offices and their employees, and all agents, contractors, consultants, attorneys and law firms and other persons engaged directly or indirectly (e.g., employee of a consultant) by or under the control of GM (including all business units and persons previously referred to), in or after January 1, 2002, were involved in any way with any of the following related to the alleged defect in the subject vehicles:

- a. Design, engineering, analysis, modification or production (e.g. quality control);
- b. Testing, assessment or evaluation;
- c. Consideration, or recognition of potential or actual defects, reporting, record-keeping and information management, (e.g., complaints, field reports, warranty information, part sales), analysis, claims, or lawsuits; or
- d. Communication to, from or intended for zone representatives, fleets, dealers, or other field locations, including but not limited to people who have the capacity to obtain information from dealers."

This response was compiled and prepared by this office upon review of the documents produced by various GM locations, and does not include documents generated or received at those GM locations subsequent to their searches.

Please contact me if you require further information about this response or the nature or scope of our searches.

Sincerely,



M. Carmen Benavides
Director, Product Investigations
and Safety Regulations

Attachments