



April 12, 2006

Jeffrey L. Quandt, Chief
 Vehicle Control Division
 Office of Defects Investigation
 NHTSA Enforcement
 Room #5326
 400 Seventh Street, S.W.
 Washington, D.C. 20590

GM-686

NVS-213cla
 PE06-006

Dear Mr. Quandt:

This letter is General Motors' (GM) response to your information request (IR), dated February 16, 2006, regarding alleged timing chain failure resulting in engine stall while driving on 2000-2003MY Saturn L-series vehicles, 2002-2003MY Saturn Vue vehicles, and 2003MY Saturn Ion vehicles equipped with the 2.2L engine (L61) manufactured for sale or lease in the United States. The scope of this investigation is the timing chain assembly (timing chain, oil nozzle, tensioner, and guides) as the primary contributory factor for the engine stall.

Your questions and our corresponding replies are as follows:

1. **State, by model and model year, the number of subject vehicles GM has manufactured for sale or lease in the United States. Separately, for each subject 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 vehicles produced for sale or lease in the United States by model and model year in Table 1 below:

<u>Make/ Model/ Model Year</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>Total</u>
Saturn L-series	53,255	60,892	70,964	58,393	243,504
Saturn Vue	N/A	N/A	13,083	59,250	72,333
Saturn Ion	N/A	N/A	N/A	96,312	96,312
Total	53,255	60,892	84,047	213,955	412,149

TABLE 1 VEHICLE PRODUCTION
 N/A NOT APPLICABLE

The production information requested in 1a-h is provided on the Attachment 1 CD, in the folder labeled: "Response for Q1;" refer to the Microsoft Access 2000 file labeled PRODUCTION DATA. GM is providing the state where the vehicle was shipped in response to request 1h. For some of the subject vehicles, which have incomplete warranty files, the GM warranty system does not contain a warranty start date or state where the vehicle was shipped, and therefore these fields are blank in the Microsoft Access 2000 file.

2. **State the number of each of the following, received by GM, or of which GM 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 vehicle stall was reported**
 - c. **Field reports, including dealer field reports;**
 - d. **Field reports, including dealer field reports where a vehicle stall was reported;**
 - 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 GM is or was a party to the arbitration; and**
 - h. **Lawsuits, both pending and closed, in which GM 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 GM'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.

Table 2-1 below summarizes records that indicate engine stall as a result of timing chain failure. Table 2-2 summarizes records that indicate the timing chain broke or was replaced but did not indicate whether the vehicle was parked or being driven at the time of the failure. GM is also providing these reports.

To date, GM's investigation of the alleged defect has not included an assessment of the cause(s) of each incident responsive to Request No. 2. Some incident reports may not contain sufficient reliable information to accurately assess cause.

TYPE OF REPORT	GM REPORTS	SUBCATEGORIES			
		CORRESPONDING TO NHTSA REPORTS	NUMBER WITH PROPERTY DAMAGE	NUMBER WITH CRASH	NUMBER WITH INJURIES/FATALITIES
Owner Reports	217	5	0	0	0
Field Reports	11	0	0	0	0
Not-In-Suit Claims	0	0	0	0	0
Subrogation Claims	0	0	0	0	0
Third Party Arbitration Proceedings	0	0	0	0	0
Product Liability Lawsuits	0	0	0	0	0
Total Reports (Including Duplicates)	228	5	0	0	0
Total Vehicles with Reports (Unique VIN)	228	5	0	0	0

TABLE 2-1: REPORT BREAKDOWN- STALL WHILE DRIVING

TYPE OF REPORT	GM REPORTS	SUBCATEGORIES			
		CORRESPONDING TO NHTSA REPORTS	NUMBER WITH PROPERTY DAMAGE	NUMBER WITH CRASH	NUMBER WITH INJURIES/FATALITIES
Owner Reports	722	9	0	0	0
Field Reports	70	1	0	0	0
Not-In-Suit Claims	0	0	0	0	0
Subrogation Claims	0	0	0	0	0
Third Party Arbitration Proceedings	0	0	0	0	0
Product Liability Lawsuits	0	0	0	0	0
Total Reports (Including Duplicates)	792	10	0	0	0
Total Vehicles with Reports (Unique VIN)	787	9	0	0	0

TABLE 2-2: REPORT BREAKDOWN- OTHERS

SOURCE SYSTEM	LAST DATE GATHERED
Customer Assistance Center (CAC)	3/02/2006
Technical Assistance Center (TAC)	3/02/2006
Field Information Network Database (FIND)	3/09/2006
Company Vehicle Evaluation Program (CVEP)	2/24/2006
Captured Test Fleet (CTF)	2/24/2006
Early Quality Feedback (EQF)	2/24/2006
Field Product Report Database (FPRD)	3/9/2006
Legal / Employee Self Insured Services (ESIS) / Product Liability Claims and Lawsuits	3/10/2006

TABLE 2-2 DATA SOURCES

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. GM'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. Whether any warning lights were lit at the time the alleged defect occurred;
 - j. Whether the vehicle was towed into the dealership;
 - k. Whether the vehicle stalled as a result of the alleged defect;
 - l. Whether the driver was able to restart the vehicle, when the vehicle stalled;
 - m. If the driver was able to restart the vehicle after stalling, what amount of time did it take;
 - n. Diagnostic Trouble Code(s) (DTCs) indicated at the time of repair;
 - o. Repair(s) dealer made to the vehicle;
 - p. Whether a crash is alleged;
 - q. Whether property damage is alleged;
 - r. Number of alleged injuries, if any; and
 - s. Number of alleged fatalities, if any;
 - t. 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 preformatted table that provides further details regarding this submission.

GM is providing the requested information in 3(a-h and p-s) in Attachment 1 CD, folder labeled: "Response for Q3;" refer to Microsoft Access file named "Request Number Two Data." The information requested in 3i-o and 3t is also provided, where available, in the attached documentation. In response to 3j, GM has included a column in the master table and has provided this information where available.

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 GM used for organizing the documents.**

Copies of the records summarized in Table 2-1 are embedded in the file provided in Attachment 1 CD GM; folder labeled: "Response for Q3," refer to the Microsoft Access file. GM has organized the records by the GM file number within each attachment.

5. **State, by model and model year, a total count for all of the following categories of claims, collectively, that have been paid by GM to date that relate to, or may relate to, the alleged defect in the subject vehicles including repair or replacement of the timing chain or timing chain oiling nozzle: warranty claims; extended warranty claims; claims for good will services that were made in accordance with the procedure specified in the subject service bulletin; field, zone, or similar adjustments and reimbursements; and warranty claims or repairs made.**

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

- a. **GM'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. **Whether any warning lights were lit at the time the alleged defect occurred;**
- g. **Whether the vehicle was towed into the dealership;**
- h. **Whether the vehicle stalled as a result of the alleged defect;**
- i. **Whether the driver was able to restart the vehicle, when the vehicle stalled;**
- j. **If the driver was able to restart the vehicle after stalling, what amount of time did it take;**
- k. **Repairing dealer's or facility's name, telephone number, city and state or ZIP code;**
- l. **Labor operation number;**
- m. **Problem code;**
- n. **Diagnostic Trouble Code(s) (DTCs) indicated at the time of repair;**
- o. **Replacement part number(s) and description(s);**
- p. **Concern stated by customer; and**
- q. **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.

Regular Warranty

The focus of this investigation is engine stall while driving as a result of timing chain assembly failure. Timing chain assembly failures may cause damage to other internal engine components (bent valves, pistons, cylinders) and vice versa, engine component failures may cause the timing chain to break. Depending on the extent of damage, the repair(s) made could range from individual engine components to a complete engine replacement. Considering these factors and the inconsistency of the labor codes used, the GM Claim Adjustment Retrieval

Database (CARD) regular and the Motors Insurance Corp (MIC) extended warranty databases were searched using the 32 labor codes listed in "Response to Q5", "Labor code" file on the Attachment 1 CD.

GM reviewed each warranty claim comment field and has identified claims where it was reported that the vehicle stalled while driving as a result of a broken timing chain. In Table 5-1, GM states the number of unique VIN regular warranty claims where the comments mentioned the engine stalled while driving and where the timing chain assembly was the likely cause of the engine failure.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	41	155	55	2	253
Saturn Vue	N/A	N/A	4	0	4
Saturn Ion	N/A	N/A	N/A	1	1
TOTAL	41	155	59	3	258

TABLE 5-1 REGULAR WARRANTY CLAIMS (UNIQUE VINS) - STALLED WHILE DRIVING

In Table 5-2, GM states the number of unique VIN regular warranty claims where the comment mentioned stall, engine quit/ died, no start, or the timing chain broke/ was replaced but there was not information to determine if the incident occurred when the vehicle was parked or if the engine stalled while driving. The S-pin timing chain was implemented in May 2002, affecting 2002MY vehicles and beyond. The claims occurring in 2003MY are likely addressing noise or engine performance issues, such as rough idle.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	350	767	256	15	1388
Saturn Vue	N/A	N/A	55	162	217
Saturn Ion	N/A	N/A	N/A	32	32
TOTAL	350	767	311	209	1637

TABLE 5-2 REGULAR WARRANTY CLAIMS (UNIQUE VINS) -OTHER

Extended Warranty- Universal Warranty Corp. (UWC)

GM reviewed the UWC extended warranty claim comments and has identified claims where it was reported that the vehicle stalled while driving and the timing chain was broken. See Table 5-3. UWC extended warranty database was searched through a process that identifies the applicable vehicle system, parts descriptions, and keywords.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	0	3	0	0	3
Saturn Vue	N/A	N/A	0	0	0
Saturn Ion	N/A	N/A	N/A	0	0
TOTAL	0	3	0	0	3

TABLE 5-3 UWC EXTENDED WARRANTY CLAIMS (UNIQUE VINS)- STALL WHILE DRIVING

In Table 5-4, GM states the number of UWC extended warranty claims where there is not information to determine if the engine stalled while driving or when parked but the comment mentioned stall, engine quit/ died, no start, or the timing chain was broke/ replaced.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	1	1	2	0	4
Saturn Vue	N/A	N/A	0	0	0
Saturn Ion	N/A	N/A	N/A	0	0
TOTAL	1	1	2	0	4

TABLE 5-4 UWC EXTENDED WARRANTY CLAIMS (UNIQUE VINS)- OTHER

Extended Warranty- Motors Insurance Corp.

The MIC extended warranty database was searched using the same 32 labor codes used for the regular warranty. Since there are no claim comments, GM is unable to determine the number of claims, if any, where the engine stalled while driving as a result the timing chain assembly failure. In Table 5-5, GM states the number of MIC extended warranty claims for the timing chain assembly replace labor code, J0820. These claims may be to address noise or engine performance issues, such as rough idle.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	0	0	0	0	0
Saturn Vue	N/A	N/A	8	11	19
Saturn Ion	N/A	N/A	N/A	5	5
TOTAL	0	0	8	16	24

TABLE 5-5 MIC EXTENDED WARRANTY CLAIMS (UNIQUE VINS) - J0820 TIMING CHAIN

For consistency, GM is reporting the number of MIC extended warranty claims for the other 31 labor codes used in the search in Table 5-6. Without claim comments, GM is unable to determine the root cause of the repairs or replacements. The S-pin timing chain was implemented between April and May 2002, affecting 2002MY vehicles and beyond. These claims may be to address noise or engine performance issues, such as rough idle.

MAKE/MODEL	2000MY	2001MY	2002MY	2003MY	TOTAL
Saturn L-series	0	0	0	0	0
Saturn Vue	N/A	N/A	30	161	191
Saturn Ion	N/A	N/A	N/A	84	84
TOTAL	0	0	30	245	275

TABLE 5-6 MIC EXTENDED WARRANTY CLAIMS (UNIQUE VINS) - 31 OTHER LABOR CODES

A summary of the warranty claims for Tables 5-1 through 5-6 are provided on the Attachment 1 CD; refer to the folder labeled: "Response to Q5." There are cases where the dealers used multiple labor codes/claims for the same VIN and incident. For this reason, the number of records provided will be greater than the counts provided in the tables. The information requested in 5f-j, n, p and q may be contained within the regular and UWC extended warranty claims. The MIC extended warranty claims do not contain the information requested in 5f-j or m-q.

The sources of the requested information and the last date the searches were conducted are tabulated in Table 5-7 below.

SOURCE SYSTEM	LAST DATE GATHERED
GM CARD --regular warranty	2/20/2006
Motors Insurance Corporation (MIC) -- extended warranty	2/27/2006
Universal Warranty Corporation (UWC) -- extended warranty	2/28/2006

TABLE 5-7: DATA SOURCES

The warranty data provided has limited analytical value in analyzing the field performance of a motor vehicle component. The warranty records do not contain sufficient information to establish the condition of the part at the time of the warranty correction; and service personnel may not consistently use the appropriate labor and trouble codes. Warranty numbers represent claims by our dealers for reimbursement for parts, labor, and other (such as towing and rental car) costs incurred in performing warranty service for our customers.

- 6. Describe in detail the search criteria used by GM 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 GM 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 GM 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.**

See the response to question 5 for the search criteria used to identify warranty claims.

The subject vehicles are covered by a bumper-to-bumper new vehicle warranty for three years or 36,000 miles whichever occurs first. Many different extended warranty options are available through GM dealerships. They are offered at different prices and for varying lengths of time, based on customer's preference, up to 7 years from the date of purchase or up to a total of 100,000 vehicle miles. The GM warranty system does not contain information on the number of vehicles that have extended warranty coverage.

- 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.**

GM has identified the following communications that relate to the alleged defect on the subject vehicles in Table 7. Copies of the communications are provided on the Attachment 1 CD; refer to the folder labeled: "Response to Q7." GM is not planning to issue any service, warranty, or other documents within the next 120 days.

DOCUMENT I.D.	DOCUMENT TITLE	ISSUE DATE
1341990	Info- Timing Chain Design Change and Revised Service Procedures #03-06-01-017	6/9/2003
1480369	2.2 L61 Engine Crank, No Start – kw break broken chain cylinder head knock lubrication no noise no start nozzle oil timing #PI00434A	3/22/2004

TABLE 7 BULLETINS AND OTHER DOCUMENTS

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, GM. 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.

The L61 engines for the 2000-2003MY Saturn L-series vehicles were built at GM's Tonawanda engine plant. The L61 engines for the 2002-2003MY Saturn Vue and the 2003MY Saturn Ion vehicles were built at GM's Springhill engine plant. Engineering responsibility for the L61 engine was with GM-Europe(GME) from 1999-mid 2002CY. It was transferred to GM Powertrain North America.

Table 8 below summarizes the actions performed by GM that relate to the subject condition. Documents are provided in the attachments as noted in the table. Data was gathered through April 12, 2006.

<p>Action: 8A, Engine Teardowns Start Date: Start of Production 1999 End Date: On-going Engineering Group: GM Powertrain Attachments: Documents can be found on Attachment 1CD, “Response to Q8” folder, “Action 8A” folder Description: Perform engine teardowns on certain returned engines to determine root cause of failures. Not all returned engines are analyzed. This process is typically utilized as an early feedback tool at product launches or requested for specific issues. Summary of Action: Generate engine teardown detail report and communicate findings to GM Powertrain engineering, Vehicle Engineering, Engine Assembly Plant personnel, and part suppliers as deemed necessary.</p>

<p>Action: 8B, PRTS L850 prov3BD24C Start Date: August 2001 End Date: December 2004 Engineering Group: GM Powertrain Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8B" folder Description: Investigate 2000-2001MY Saturn L-series with broken timing chains where the vehicle suddenly stops running or stalls. Summary of Action: Reviewed warranty claims. Considering the S-pin timing chain released for the higher performance applications to improve robustness. Start development and validation testing of the S-pin timing chain.</p>
<p>Action: 8C, PRTS N112642 Start Date: August 2002 End Date: January 2005 Engineering Group: GM Powertrain, Tonawanda Engine Plant Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8C" folder and Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8C" folder Description: Eliminate occurrences where engines are returned with broken timing chains, cylinder head damage, and head gasket failure. Summary of Action: Warranty cost reduction was achieved by increasing component robustness. A full time flow oil nozzle with a torque limiting sleeve and the S-pin timing chain (double chromised pins) was released to address lubrication and wear conditions.</p>
<p>Action: 8D, PRTS N116026A Start Date: November 2002 End Date: April 2003 Engineering Group: GM Powertrain, Tonawanda Engine Plant Attachments: Documents can be found on Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8D" folder Description: Investigate broken timing chain on L61 engine replaced on Chevrolet Cavalier. Summary of Action: Root cause determined to be a loose bolt found in the balance shaft bore, which caused the balance shaft to lock up and break the timing chain. Revised the engine assembly line work instructions. Lessons learned forwarded to other L61 engine operations including the Saturn Spring Hill engine plant.</p>
<p>Action: 8E, PRTS N120886 Start Date: March 2003 End Date: This PRTS closed and tracked via PRTS N119385 for a similar issue. Engineering Group: GM Powertrain, Tonawanda Engine Plant Attachments: Documents can be found on Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8E" folder Description: Eliminate occurrences of L61 engine returns due to aluminum chips impeding the flow of oil. Summary of Action: This PRTS was closed and the initiatives to reduce/ eliminate excess chips from the machining process were tracked via PRTS N119385.</p>
<p>Action: 8F, PRTS N119385 Start Date: February 28, 2003 End Date: January 21, 2004 Engineering Group: GM Powertrain, Tonawanda Engine Plant Attachments: Documents can be found on Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8F" folder Description: Analyze a L61 engine built at the Tonawanda Engine Plant returned with the customer complaint that "car died while driving" (2003MY Chevrolet Cavalier) and a connecting rod bearing spun. Summary of Action: While no definitive root cause was determined for this specific engine, the Tonawanda engine plant added equipment and enhanced washout and blow-off operations. Forwarded lessons learned to other plants that manufacture the L61 engine (Saturn Spring Hill and GME).</p>

<p>Action: 8G, GME Risk Assessment L850 Timing Chain Start Date: March 2003 End Date: July 2003 Engineering Group: GME- Fiat GM Powertrain Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8G" folder and Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8G" folder Description: Develop risk assessment for GME vehicles utilizing L61 engine. Summary of Action: Performed a timing chain service campaign on certain 2001MY GME and GM Thailand vehicles with the L61 engines.</p>
<p>Action: 8H, Engine Validation Start Date: May 2003 End Date: October 2003 Engineering Group: GM Powertrain Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8H" folder Description: Perform low speed durability engine validation for the new S-pin timing chain and oil nozzle. Summary of Action: Successfully completed the validation test.</p>
<p>Action: 8I, PRTS N162835 Start Date: June 2004 End Date: October 2004 Engineering Group: GM Powertrain, Tonawanda Engine Plant Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8I" folder and Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8I" folder Description: Investigate complaints of excessive front of engine clicking noise. Summary of Action: Determined the root cause to be cylinder head machining chip contamination in the oil feed to the timing chain tensioner. The Tonawanda engine plant addressed chip washout and blow-off operations that follow engine block machining operations. Also, the tensioner oil feed hole was increased from 0.8 to 3 mm. Lessons learned forwarded to all GMNA assembly plants that install the L61 engine including the Saturn Spring Hill.</p>
<p>Action: 8J, Warranty Analysis Start Date: January 2006 End Date: February 2006 Engineering Group: GM Powertrain FPE Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8J" folder Description: Reviewed warranty on Saturn L-series for timing chain and/or engine replace. Summary of Action: Warranty analysis conclusion was that the majority of timing chain replacements occurred during the warranty period.</p>
<p>Action: 8K, GM's Assessment of the VOQs Start Date: March 2006 End Date: April 2006 Engineering Group: GM Product Investigations Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8K" folder Description: Review the VOQs attached to the NHTSA request. Summary of Action: GM has reviewed the VOQs attached with this request and provided additional information.</p>
<p>Action: 8L, Product Investigations Data Analysis Start Date: March 2006 End Date: Ongoing Engineering Group: GM Product Investigations Attachments: Documents can be found on Attachment 1CD, "Response to Q8" folder, "Action 8L" folder and on Attachment 2CD-CONFIDENTIAL, "Response to Q8" folder, "Action 8L" folder Description: Review the data pulled for this investigation. Summary of Action: Generated various IPTV warranty charts and performed data analysis.</p>

TABLE 8 ACTIONS

9. Describe all modifications or changes made by, or on behalf of, GM in the design, material composition, manufacture, quality control, supply, or installation of the subject component, 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:
- The date or approximate date on which the modification or change was incorporated into vehicle production;
 - A detailed description of the modification or change;
 - The reason(s) for the modification or change;
 - The part numbers (service and engineering) of the original component;
 - The part number (service and engineering) of the modified component;
 - Whether the original unmodified component was withdrawn from production and/or sale, and if so, when;
 - When the modified component was made available as a service component; and
 - Whether the modified component can be interchanged with earlier production components.

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

GM is providing a summary of the GM product engineering information requested in 9(a-h), along with copies of the GM Engineering Work Orders in Attachment 1 CD, folder labeled: "Response for Q9."

GM is not planning to incorporate any modifications or changes into production of the subject vehicles that relate to the alleged defect within the next 120 days.

10. State the number of subject components that GM has sold that may be used in the subject vehicles by state, part number (both service and engineering/production), model and model year of the vehicle in which it is used and month/year of sale (*including the cut-off date for sales, if applicable*). If part sales data cannot be provided by state, provide it by part distribution center with a description of the region covered by each center.

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, any other vehicles of which GM is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

The requested information is provided on the CD in Attachment 1, in the folder labeled: "Response to Q10." These sales numbers represent sales to dealers worldwide. 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.

Monthly part sales information available for the most recent 24 months has been included.

The source of the Saturn part sales information was gathered on April 10, 2006.

11. Furnish GM'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 condition(s) under which the alleged defect can occur;**
- e. **The 12- and 24-month warranty rates associated with the alleged defect;**
- f. **The 5- and 10-year projected subject system failure rates;**
- g. **The percentage of subject component failures that will result in an engine stalling incident;**
- h. **The ability to restart a vehicle that has stalled due to the alleged defect;**
- i. **The risk to motor vehicle safety that it poses;**
- j. **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**
- k. **The reports included with this inquiry.**

In 2003, GM investigated timing chain failures (see Response to question 8, Action 8G, GME Risk Assessment L850 Timing Chain) and did not believe there was an unreasonable risk to safety. GM has reviewed the data gathered for this response and continues to believe there is no unreasonable risk to safety for the following reasons:

- the low IPTV warranty rate,
- a decreasing incremental IPTV rate,
- potential warning to the driver, and
- no reported crashes, injuries, or fatalities.

System Description

The internal engine components operate interdependent of each other and are timed for optimum engine performance and operation. A failure of any one component may cause subsequent damage to other components. Timing chain assembly failures may cause damage to other internal engine components (bent valves, pistons, cylinders) and vice versa, engine component failures may cause the timing chain to break. The focus of this investigation is the timing chain assembly (timing chain, oil nozzle, tensioner, tensioner lever, and guide) as the primary contributory cause for engine stall.

A timing chain may become worn or damaged:

- as a result of skipping teeth (i.e., chain links) due to improper adjustment, incorrect installation, or other internal engine parts (cams, valves, cylinders, pistons, sleeves) seizing, binding, or colliding
- when there is insufficient lubrication of the chain for an extended period of time,
- when it does not have proper tension,
- when an object obstructs its path or get lodged in the links, such as a loose bolt, or
- due to improper manufacturing.

The timing chain is essential to proper operation of the engine components. There are alignment indicators on the timing chain links, the intake sprocket, exhaust sprocket, and the crank sprocket that must match up the position of the cams, pistons, intake valves, and exhaust valves in order for the engine to function properly. A loose or stretched timing chain has excessive chain slack which may result in the chain slapping into the chain guides. A loose, stretched, or bound timing chain may result in "skipped links." Depending on the number of

links skipped and the direction of the "skip" (i.e. drops behind or jumps ahead), the engine will either run rough with excessive noise or will not run.

The oil nozzle used for this application was originally a pintle valve and regulator spring design. In this design, the nozzle flow rate was 700ccm at an oil pressure of 100kPa, with reduced flow at lower pressures. In 2002, it was speculated that excessive idling in traffic could possibly contribute to conditions leading to insufficient lubrication of the timing chain components on some engines. As such, enhancements were made in May 2002 to the oiling system to insure lubrication under all idling conditions, even though only a small fraction of engines were susceptible. The design change included increasing the size of the nozzle orifice and elimination of the pintle valve.

The operation of the oil nozzle can also be affected by lack of proper oil change maintenance (low oil, no oil, oil sludge), contaminated oil (loose metal chips, other debris, or oil sludge can clog oil passages in the engine and can work their way to the timing chain oil nozzle), the wrong oil filter being installed, or under excessive idle conditions. The enhancements made to the oil nozzle reduced the susceptibility to these conditions.

The L61 engine utilizes a hydraulic tensioner and tensioner lever to keep the timing chain taut. Engine oil flows through the tensioner which applies the necessary force to the chain through the tensioner lever. The internal components of the tensioner are the plunger, spring, and check valve. Tensioner malfunctions, such as a seized or loose plunger, will affect the operation of the timing chain. Over time, unaddressed tensioner issues can lead to timing chain damage. Typically, the engine continues to run until the timing chain becomes severely worn or damaged.

A severely worn or damaged timing chain may break when the engine is under high load; with cold start up/ low oil pressure being the most likely scenario. When the timing chain breaks, the engine will quit running. The vehicle will not start, re-start, or continue running with a broken timing chain. The starter will crank but the engine will not re-start. If the vehicle is in motion when the timing chain breaks, the vehicle will coast to a stop; similar to running out of gas.

Warranty and Analysis

The Saturn Vue and Ion regular warranty numbers for "stall while driving" are very low. The majority of these vehicles were manufactured after the new timing chain and oil nozzle was implemented around May 1, 2002.

GM is providing a warranty analysis for the Saturn L-series (see the response to question 8, Action 8L). The warranty analysis was performed for two separate categories: "Stalled while driving" claims and "Others." The "Others" category contains warranty claims where the comment mentioned stall, engine quit/ died, no start, or the timing chain broke/ was replaced but there is no information to determine if this occurred when parked or if the engine stalled while driving. It is possible that a small percentage of the claims in the "Others" category may have experienced the alleged defect. GM's judgment is that the majority of these warranty incidents occurred while the vehicle was parked since the timing chain is more likely to break during high load situations, including engine startup.

The cumulative 12 month warranty rate for "stall while driving" for 2000-2003MY Saturn L-series is 0.09 IPTV and the 24 month cumulative is 0.32 IPTV based on a Weibull analysis. The combined "Stalled while driving" and "Other" cumulative 12 and 24 month IPTV is 0.71 and 2.23, respectively. Weibull analysis shows the 100,000 mile projected failure rates for the combined model years (2000-2003MY) are 1.73 IPTV ("Stall while driving") and 11.3 IPTV

(combined). The Weibull slope is less than 1 indicating a decreasing failure rate as mileage increases.

Review of the warranty IPTV by build of month suggests there was a quality issue on some vehicles built from November 2000 through February 2001 (2001MY L-series). However, GM has been unable to identify a cause. The cumulative 12 month warranty rate for "stall while driving" for this four month build period is 0.49 IPTV and the 24 month cumulative is 1.93 IPTV based on a Weibull analysis. The combined "Stall while driving" and "Other" cumulative 12 and 24 month IPTV is 4.5 and 12.29, respectively. Weibull analysis shows the 100,000 mile projected failure rates for the four month period are 8.94 IPTV ("Stall while driving") and 47.98 IPTV (combined). The Weibull slope is less than 1 for both cumulative and mileage data.

Warning to the driver

If the timing chain is not properly adjusted or lubricated, the driver may notice excessive engine noise (loud, ticking, whining, knocking, metal to metal noises), less than usual engine performance (rough engine idle, misfiring, or poor acceleration), or in some cases, the service engine soon or low oil lamp warning light. When this issue is not addressed early on, the wear may become evident at oil changes with metal debris contamination. In some cases, there may be a progression of signs that the engine performance is deteriorating and may eventually stop running.

VOQ Assessment

GM's assessment of the VOQs included with this inquiry can be found in the response to question 8, Action 8K.

* * *

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 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), who are or, in or after January 1, 2000, were involved in any way with any of the following related to the alleged defect in the subject vehicles:

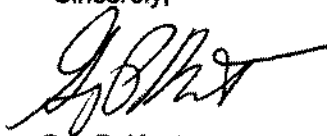
- a. Design, engineering, analysis, modification or production (e.g. quality control);
- b. Testing, assessment or evaluation;
- c. Consideration, or recognition of potential or actual defects, reporting, record-keeping and information management, (e.g., complaints, field reports, warranty information, 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.

Letter to Jeffrey L. Quandt
PE06-006 /GM-686
April 12, 2006
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Please contact me if you require further information about this response or the nature or scope of our searches.

Sincerely,

A handwritten signature in black ink, appearing to read 'G. Kent', with a long horizontal flourish extending to the right.

Gay P. Kent
Director
Product Investigations

Attachments