



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

Memorandum

Subject: **TEST REQUEST:** Hydraulic Pump Shaft Failure
GM Hydro-boost equipped vehicles, MY 2000-2004

Date: MAY 4 2004

From: Kathleen C. DeMeter, Director
Office of Defects Investigation

Reply to
Attn. of:

NVS-214ns
EA04-012

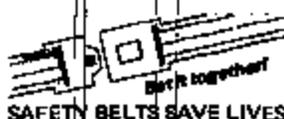
To: Mike Monk, Director
Vehicle Research and Test Center

This memo requests that the Vehicle Research and Test Center (VRTC) conduct the work described below in support of Engineering Analysis EA04-012.

BACKGROUND: On January 8, 2004, ODI opened a Preliminary Evaluation (PE04-004) to investigate allegations of hydraulic pump shaft failure, which results in a loss of power brake and/or power steering, depending on the vehicle equipment. On April 30, 2004, this investigation was upgraded to EA04-012. Copies of the PE upgrade & EA opening resumes and the PE IR response are attached.

There are 23 alleged crashes, from which minor injuries and property damage have been sustained. All of the crashes have involved vehicles with a hydro-boost power assist for the brake and steering systems. Sixteen of the crashes involved ¾ Ton 4x4 vehicles, of those 15 were pickups and 1 was a Suburban. This group of vehicles is slightly less than half the total subject vehicle population (467,947 of 1,093,806).

ODI opened the investigation based on 19 complaints of subject vehicles, Model Years 2000-2002. When ODI opened the investigation ODI was aware of only one complaint on a MY 1999 and ten for MY 2000. Therefore ODI did not include MY 1999. ODI is now aware of a design change incorporated into production in November of 1999 that may explain why the failure rate increases for model year 2000. At that time, (Nov 99) a new specification was released for the pump ring/rotor clearance and the flatness of the pump rotor. This apparently stemmed from analysis of returned pumps where the pump shaft had failed due to rubbing of the pressure plate and rotor. By design, an internal fluid leak is used to lubricate the pump. A hydrodynamic film separates the components of the pump. As pressure increases, the components are squeezed together. GM's internal study indicates that the pressure plate may deflect inward towards the rotor and exceed the hydrodynamic film thickness. This in turn can cause the rotor to bind and shear the pump driveshaft. A second change was released in February of 2004. This change increased the rigidity of the rotor by adding extra support to the vanes. Since the average warranty claim occurred at 23,000 miles, it is too early to gauge the effectiveness of the February 2004 design change. However, inventories were not



purged, and therefore it can be expected that replacement pumps will continue to fail until old inventories are exhausted.

SCOPE: During the PE, the subject vehicles were MY 2000 through 2002 GM ¾ and 1 Ton vehicles, both 2WD and 4WD chassis. When the EA was opened, ODI added MY 2003 and 2004 (built prior to the February 2004 pump change), since those vehicles apparently have the same pump. For testing purposes, ODI wishes to only consider vehicles with hydro-boost.

OBJECTIVES:

ODI's objective is to quantify the steering and braking performance degradation, which occurs when a pump shaft fails. Additionally, ODI wishes to gain an understanding of how drivers respond to the dual nature of this failure.

SUGGESTED PROTOCOL (by order of importance):

- I. Obtain the following vehicles:
 - a) ¾ Ton 4WD pickup
 - b) 1 Ton 4WD pickup
- II. Instrument vehicles to record driver input and test to FMVSS 105/135 requirement. Also record effects of failed steering system on steering effort. Quantify steering effort with power assist and without power assist. Protocol to be determined after further discussions with ODI engineer.

Optional added testing:

- III. Obtain a sample of 8 to 12 drivers, preferably owners of a subject or peer vehicle, and have them drive one of the instrumented vehicles on a prescribed course. The course will simulate normal steering and/or braking maneuvers. Incorporate a simulated failure during these maneuvers. Record the affect on vehicle control (braking & steering combination) that a pump failure has on the driver's ability to properly control the vehicle.
- IV. Obtain one or more additional subject vehicles as follows and test per Part II:
 - a. ¾ Ton 2 WD pickup
 - b. 1 Ton G-van

RECOMMENDED APPROACH: Test each chassis configuration to FMVSS 105/135 in both lightly loaded and loaded to GVWR. Monitor and record each driver's attempt at negotiating the course in a lightly loaded vehicle.

SCHEDULE: The target completion goal for Phase I and II of this test program is 3 months from receipt of the test request. Preliminary results will be reviewed by ODI after 2 months of testing to determine if Parts III or IV are necessary. If Part III is included at that time, the target to completion

goal for Parts I, II, and III will be 5 months from receipt of the test request. For Part IV, add one month for each vehicle that is added.

Additional Information: The ODI investigating engineer is Nate Seymour. All questions concerning the testing should be directed to him, at (202) 366-6965.

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Enclosure: ODI Resume PE04-004
ODI Resume EA04-XXX
GM response to IR
Summary of crash vehicles
United Nations Economic and Social Council document

